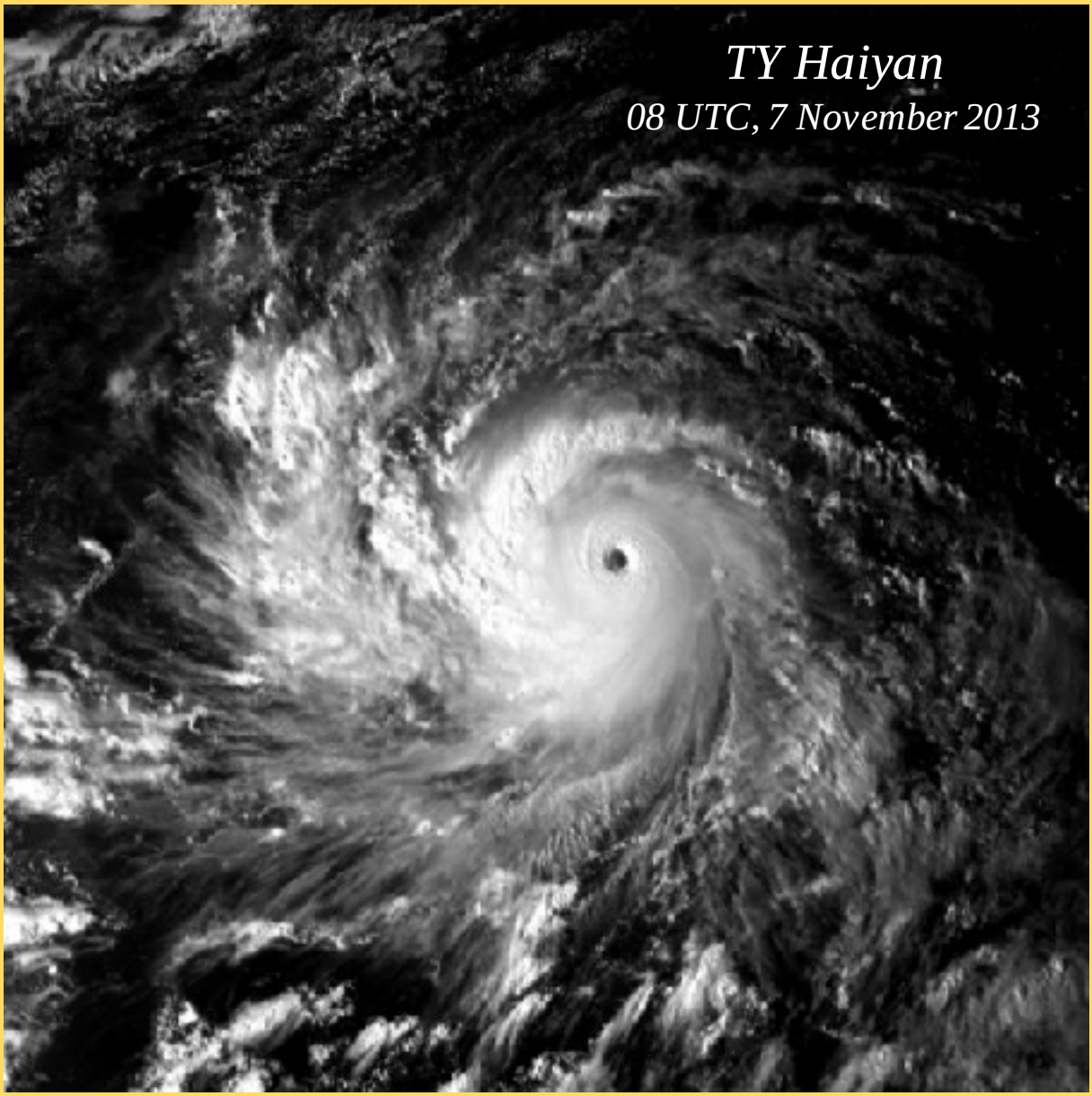
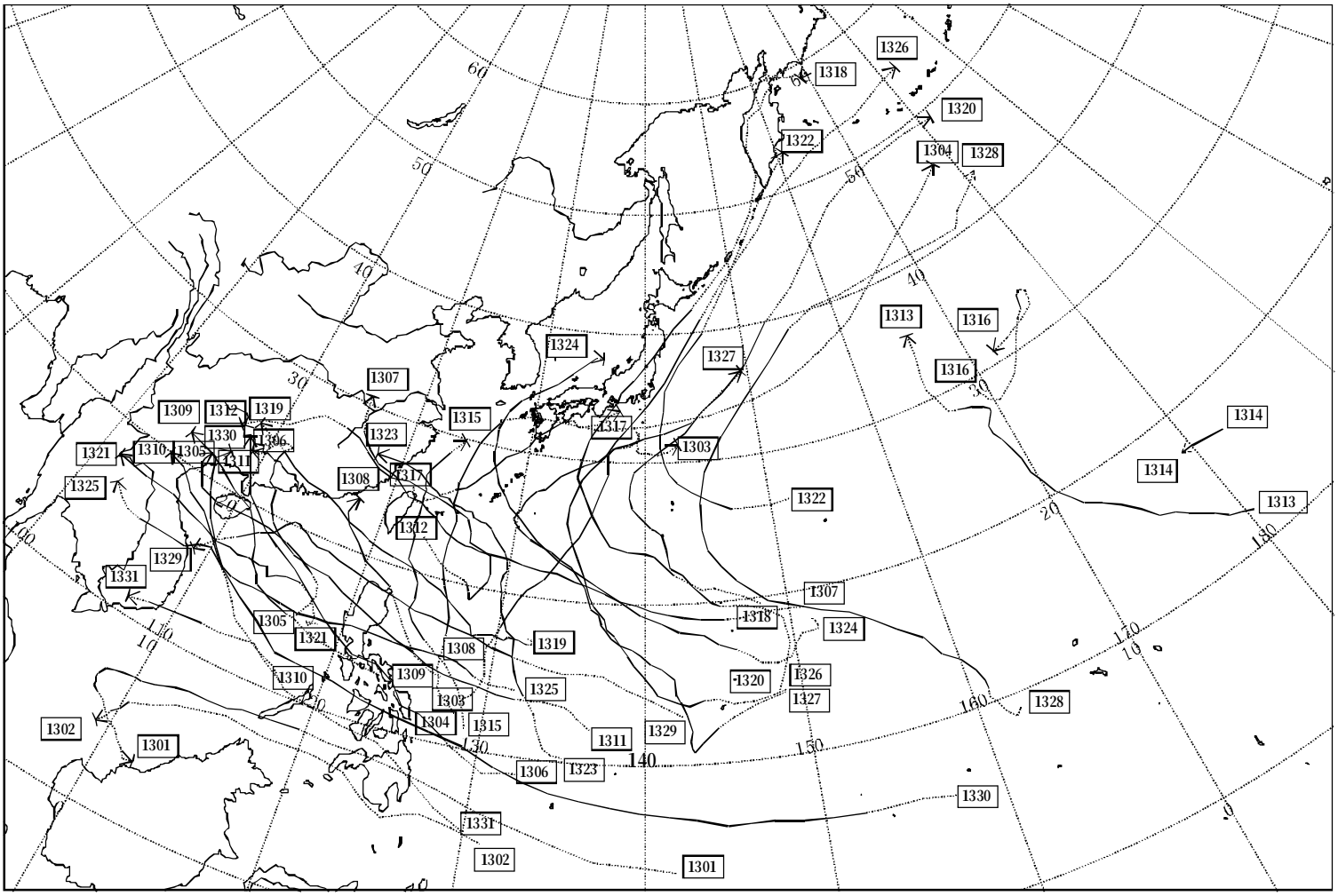
Annual Report on the Activities of the RSMC Tokyo - Typhoon Center 2013



Japan Meteorological Agency

Annual Report
on the Activities of
the RSMC Tokyo - Typhoon Center
2013



Japan Meteorological Agency

Table of Contents

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 2013, Chapter 1 outlines routine operations performed at the Center and its operational products, while Chapter 2 reports on its major activities in 2013. Chapter 3 describes atmospheric and oceanic conditions in the tropics and notes the highlights of TC activity in 2013. 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 2013 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 2013 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 2013

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.

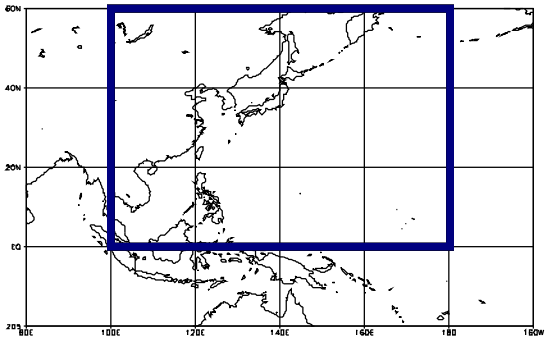


Figure 1.1
Area of responsibility of the RSMC Tokyo - Typhoon Center

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.

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 2013

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 2013 are listed in Table 2.1.

Table 2.1 Monthly and annual totals of products issued by the RSMC Tokyo - Typhoon Center in 2013

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
IUCC10	40	14	0	0	0	114	97	196	238	376	122	0	1197
WTPQ20-25	45	19	0	0	0	139	121	277	309	420	153	0	1483
WTPQ30-35	10	5	0	0	0	31	31	69	76	103	39	0	364
WTPQ50-55	5	0	0	0	0	21	18	63	56	110	27	0	300
FXPQ20-25	44	18	0	0	0	136	118	270	304	412	150	0	1452
FKPQ30-35	22	9	0	0	0	68	59	135	152	206	75	0	726
AXPQ20	3	0	1	0	0	0	4	4	3	9	7	2	33

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 2013, the 15th issue of the *RSMC Technical Review* was issued with the following areas of focus:

1. Cloud Grid Information Objective Dvorak Analysis (CLOUD) at the RSMC Tokyo - Typhoon Center

In December 2013, the Center published the *Annual Report on the Activities of the RSMC Tokyo - Typhoon Center in 2012*. 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, 2012, to 31 October, 2013, was conducted for two tropical cyclones:

1. TY Utor (1311), from 18UTC 10 August to 11UTC 15 August 2013
2. TY Nari (1325), from 12UTC 10 October to 17UTC 15 October 2013

The results were distributed to all Typhoon Committee Members in March 2014, 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 2013 Typhoon Season

In 2013, 31 TCs of tropical storm (TS) intensity or higher formed over the western North Pacific and the South China Sea. This total is above the 30-year average* frequency of 25.6. Among these 31 TCs, 13 reached typhoon (TY) intensity, 8 reached severe tropical storm (STS) intensity and 10 reached TS intensity (Table 3.1).

Table 3.1 List of tropical cyclones reaching TS intensity or higher in 2013

Tropical Cyclone			Duration (UTC) (TS or higher)				Minimum Central Pressure (UTC)	lat (N)	long (E)	(hPa)	Max Wind (kt)
STS	Sonamu	(1301)	031200	Jan	- 080000	Jan	050000	7.9	112.2	990	50
TS	Shanshan	(1302)	211800	Feb	- 221200	Feb	211800	5.9	110.3	1002	35
TS	Yagi	(1303)	081200	Jun	- 120600	Jun	101200	24.4	134.9	990	45
TS	Leepi	(1304)	180000	Jun	- 210000	Jun	181800	19.7	125.7	994	40
TS	Bebinca	(1305)	201800	Jun	- 240600	Jun	220000	19.2	111.4	990	40
STS	Rumbia	(1306)	281200	Jun	- 021200	Jul	010600	19.0	112.6	985	50
TY	Soulik	(1307)	080000	Jul	- 140000	Jul	100000	21.1	135.8	925	100
TS	Cimaron	(1308)	170000	Jul	- 181800	Jul	171800	20.7	119.0	1000	40
STS	Jebi	(1309)	310000	Jul	- 031200	Aug	020600	18.8	111.8	985	50
TS	Mangkhut	(1310)	061200	Aug	- 080000	Aug	070600	18.7	106.8	992	40
TY	Utor	(1311)	091800	Aug	- 151200	Aug	111200	15.5	123.5	925	105
STS	Trami	(1312)	180000	Aug	- 221800	Aug	202100	24.9	125.3	965	60
STS	Pewa	(1313)	181200	Aug	- 250000	Aug	190000	13.3	178.4	990	55
TS	Unala	(1314)	190600	Aug	- 191200	Aug	190600	17.5	180.0	1000	35
STS	Kong-rey	(1315)	260600	Aug	- 300000	Aug	281200	22.8	122.5	980	55
TS	Yutu	(1316)	010000	Sep	- 011800	Sep	010000	32.5	176.2	1002	35
STS	Toraji	(1317)	011800	Sep	- 040000	Sep	030000	28.6	127.5	985	50
TY	Man-yi	(1318)	130000	Sep	- 161200	Sep	151200	31.5	135.0	960	65
TY	Usagi	(1319)	161800	Sep	- 230600	Sep	191800	18.7	126.4	910	110
STS	Pabuk	(1320)	210600	Sep	- 270000	Sep	241200	26.7	138.9	965	60
TY	Wutip	(1321)	270600	Sep	- 010000	Oct	290600	16.7	111.8	965	65
TS	Sepat	(1322)	300000	Sep	- 021800	Oct	020600	35.4	141.9	992	40
TY	Fitow	(1323)	301800	Sep	- 070600	Oct	041800	23.7	128.5	960	75
TY	Danas	(1324)	040600	Oct	- 090000	Oct	070000	25.2	130.2	935	90
TY	Nari	(1325)	091200	Oct	- 151800	Oct	121800	15.1	115.7	965	75
TY	Wipha	(1326)	101200	Oct	- 160600	Oct	131200	19.8	136.4	930	90
TY	Francisco	(1327)	160600	Oct	- 260600	Oct	181800	15.9	141.1	920	105
TY	Lekima	(1328)	201800	Oct	- 261200	Oct	230000	18.6	152.2	905	115
TY	Krosa	(1329)	291800	Oct	- 040600	Nov	011800	19.4	116.4	970	75
TY	Haiyan	(1330)	040000	Nov	- 110600	Nov	071200	10.2	129.1	895	125
TS	Podul	(1331)	141200	Nov	- 150000	Nov	141200	11.9	111.7	1002	35

3.1 Atmospheric and Oceanographic Conditions in the Tropics

Slightly positive anomalies of sea surface temperature (SST) prevailed over the tropics all year round. In the South China Sea, positive SST anomalies prevailed early in the year and weakened late in the year.

Convective activity over the South China Sea and in the vicinity of the Philippines was enhanced from summer to autumn 2013 since a monsoon trough extending from the Indian Sea was dominant over the area. Especially in September and October, monthly numbers of TC formations were above the 30-year average. This contributed to an above normal number of TC formations in the year (31 in 2013 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.

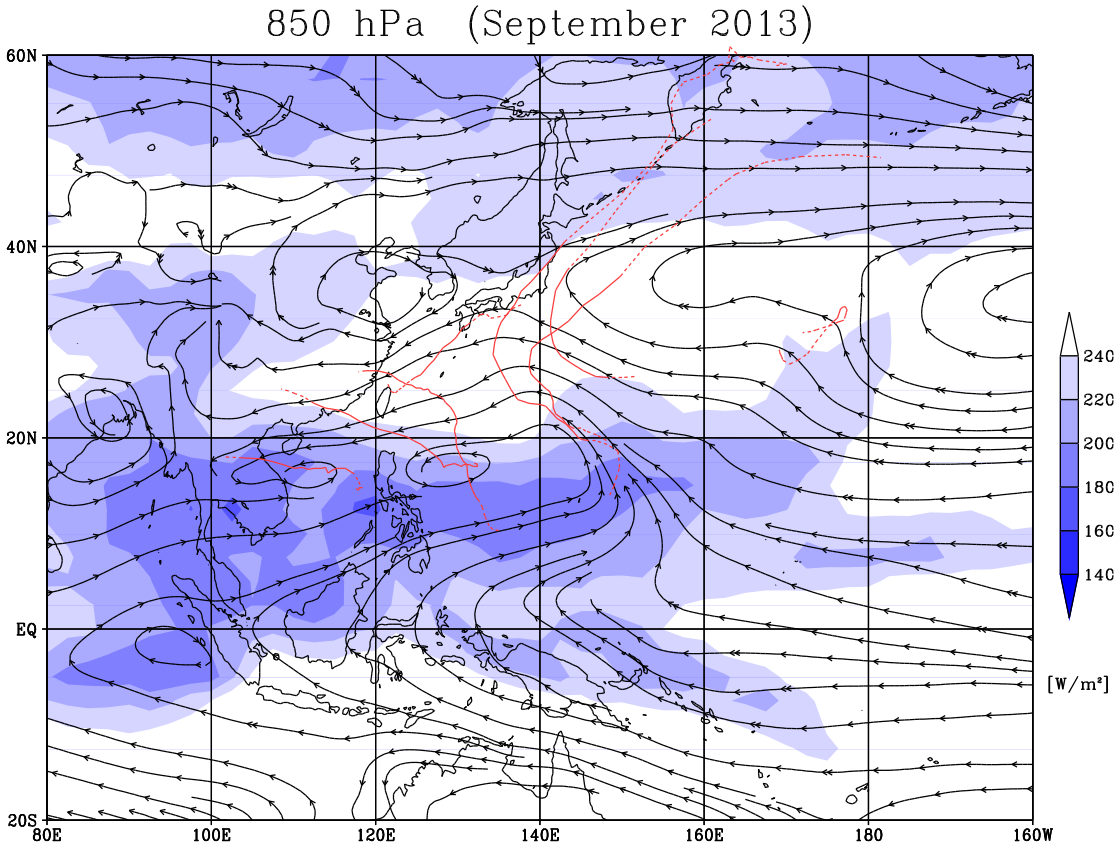


Figure 3.1 Monthly mean streamlines at 850 hPa (lines with arrows) and areas with OLR values of less than 240 W/m^2 (shaded) for September 2013. The tracks of the 8 named TCs that formed in September are superimposed onto the figure.

3.2 Tropical Cyclones in 2013

A total of 31 named TCs formed over the western North Pacific and the South China Sea in 2013. Monthly and 30-year average* TC formation numbers are shown in Figure 3.2, and tracks of the 31 TCs are shown in Figure 3.3. Figure 3.4 shows the genesis points of the 31 TCs (dots) and related frequency distribution for past years (1951 – 2012). The mean genesis point of named 29 TCs forming in 2013 excluding Pewa (1313) and Unala (1314) was at 16.1˚N and 135.7˚E, showing a southeastward deviation from the 30-year average* (16.2˚N and 137.4˚E).

The 2013 TC season began with the formation of Sonamu (1301) early in January, which formed over the Sulu Sea. Seven named TCs hit the continent from June to August and six from September to November. The total of named TCs which hit the continent was 13 during the season. In November, Haiyan (1330) formed and caused devastation in the Philippines. Detailed descriptions of each TC forming in 2013 are included on the DVD provided with this report.

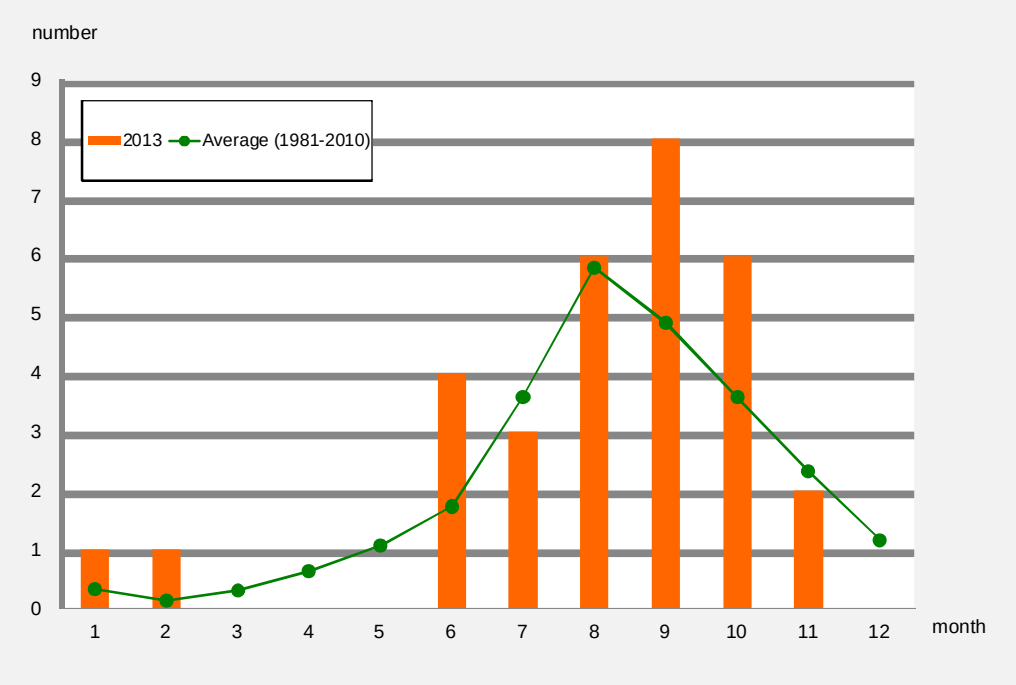


Figure 3.2 Monthly TC formation numbers for 2013 compared to the 30-year average*

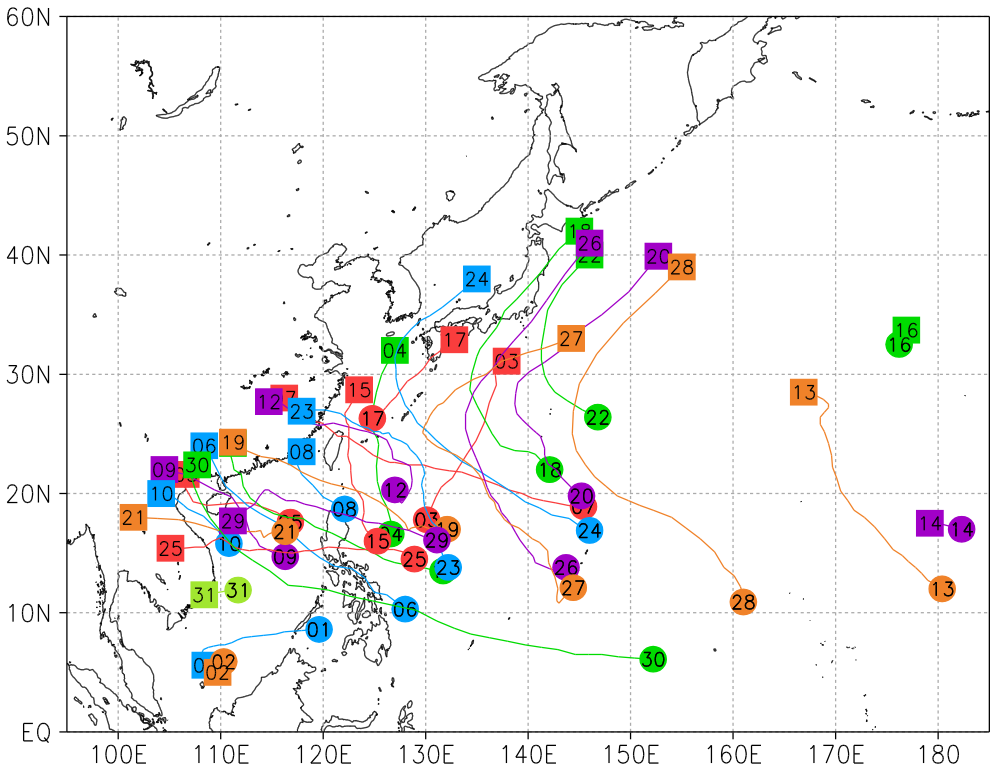


Figure 3.3 Tracks of the 31 named TCs forming in 2013. TC tracks for those with an intensity of TS or higher are shown.

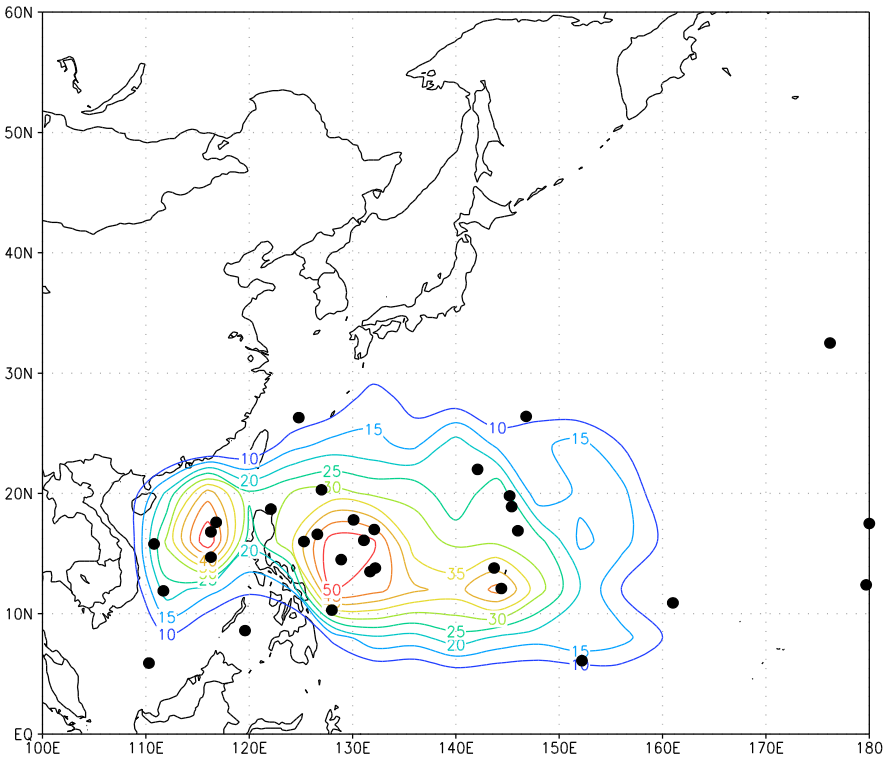


Figure 3.4 Genesis points of the 31 TCs forming in 2013 (dots) and related frequency distribution for 1951 – 2012 (lines)

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

Chapter 4

Verification of Forecasts in 2013

4.1 Verification of Operational Forecasts

Operational forecasts for the 31 TCs of TS intensity or higher that formed in 2013 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 2013 are indicated in Appendix 3.

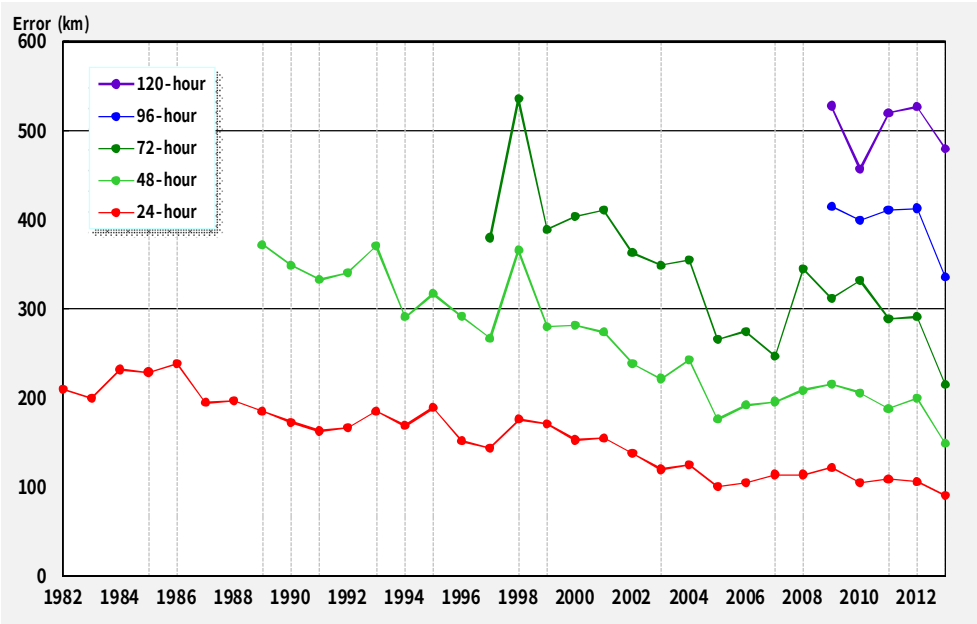


Figure 4.1 Annual mean position errors in 24-, 48-, 72-, 96- and 120-hour operational track forecasts

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 2013 were 91, 149, 215, 336 and 480 km for 24-, 48-, 72-, 96- and 120-hour forecasts, respectively.

The details of errors for each TC forming in 2013 are summarized in Table 4.1. The forecasts for Yagi (1303), which moved from east of the Philippines to south of Honshu Island, were characterized by large errors. The 96- and 120-hour forecasts for Wipha (1326), which recurved around Japan, also showed large errors, while forecasts for Sonamu(1301), Soulik (1307) and Francisco (1327) 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 2013 were 41% (44% in 2012), 31% (38%), 30% (36%),

41% (38%) and 42% (43%), respectively. Figure 4.2 shows a histogram of 24-hour forecast position errors. About 86% (78% in 2012) of 24-hour forecasts, 91% (82%) of 48-hour forecasts, 93% (82%) of 72-hour forecasts, 84% (72%) of 96-hour forecasts and 74% (75%) 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 2013. 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 (%)
STS	Sonamu	(1301)	67	41	14	37	96	49	10	22	105	38	6	13	180	1	2	-	-	-	0	-
TS	Shanshan	(1302)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TS	Yagi	(1303)	177	57	11	80	406	55	7	125	491	72	3	70	-	-	0	-	-	-	0	-
TS	Leepi	(1304)	93	37	8	41	118	89	4	52	-	-	0	-	-	-	0	-	-	-	0	-
TS	Bebinca	(1305)	155	86	10	47	236	142	5	35	352	0	1	-	-	-	0	-	-	-	0	-
STS	Rumbia	(1306)	150	64	12	81	311	98	8	109	422	56	4	116	-	-	0	-	-	-	0	-
TY	Soulik	(1307)	46	37	20	48	60	33	16	29	83	32	12	43	148	68	8	46	258	28	4	35
TS	Cimaron	(1308)	148	83	3	23	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
STS	Jebi	(1309)	77	20	10	39	114	26	6	31	175	40	2	-	-	-	0	-	-	-	0	-
TS	Mangkhut	(1310)	129	4	2	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Utor	(1311)	97	64	19	53	194	111	15	46	286	185	11	50	312	199	7	33	363	63	3	25
STS	Trami	(1312)	108	50	15	30	133	80	11	18	112	50	7	7	179	50	3	8	-	-	0	-
STS	Pewa	(1313)	112	66	22	60	181	94	18	42	307	126	14	45	447	121	10	50	734	255	6	118
TS	Unala	(1314)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
STS	Kong-rey	(1315)	60	25	11	39	147	39	7	64	216	96	3	11	-	-	0	-	-	-	0	-
TS	Yutu	(1316)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
STS	Toraji	(1317)	139	82	5	183	393	0	1	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Man-yi	(1318)	100	102	10	20	130	67	6	8	274	8	2	-	-	-	0	-	-	-	0	-
TY	Usagi	(1319)	98	71	22	56	135	110	18	31	194	108	14	22	235	65	10	19	185	108	6	12
STS	Pabuk	(1320)	66	30	19	26	83	37	15	17	198	89	11	33	406	228	7	42	461	206	3	43
TY	Wutip	(1321)	81	42	11	35	199	100	7	36	507	89	3	232	-	-	0	-	-	-	0	-
TS	Sepat	(1322)	56	19	7	15	100	16	3	10	-	-	0	-	-	-	0	-	-	-	0	-
TY	Fitow	(1323)	61	37	22	48	85	39	18	23	139	43	14	26	328	108	10	64	588	128	6	76
TY	Danas	(1324)	81	54	15	29	125	65	11	19	270	121	7	22	758	18	3	92	-	-	0	-
TY	Nari	(1325)	80	38	21	52	162	74	17	45	181	74	13	33	231	112	9	48	268	57	5	31
TY	Wipha	(1326)	76	21	19	29	167	76	15	36	299	95	10	39	594	148	6	44	1149	34	2	43
TY	Francisco	(1327)	68	47	36	29	88	32	31	18	136	62	27	22	256	96	23	41	388	118	19	39
TY	Lekima	(1328)	85	46	19	20	142	83	15	16	150	80	11	12	395	91	7	41	971	67	3	81
TY	Krosa	(1329)	96	52	18	61	199	73	14	53	308	79	10	44	449	58	6	35	610	34	2	-
TY	Haiyan	(1330)	120	62	25	67	192	98	21	44	273	111	17	50	401	162	13	47	550	154	9	46
TS	Podul	(1331)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
Annual Mean (Total)			91	61	406	41	149	101	299	31	215	131	202	30	336	177	124	41	480	258	68	42

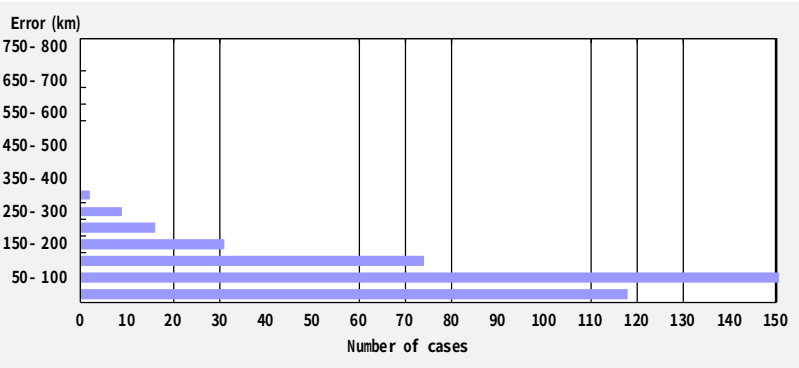


Figure 4.2 Histogram of 24-hour forecast position errors in 2013
(Histograms for 48-, 72-, 96- and 120-hour forecasts are included on the DVD provided with this report).

Table 4.2 presents the mean hitting ratios and radii of 70% probability circles* provided in operational forecasts for each TC forming in 2013. The term *hitting ratio* here is used to describe the ratio of the number of 70% probability circles within which the actual TC center fell to the total number of circles. The annual mean radius of circles provided in 24-hour position forecasts was 140 km (142 km in 2012), and their hitting ratio was 82% (76%). The corresponding values for 48-hour forecasts were 243 km (250 km in 2012) and 82% (71%), those for 72-hour forecasts were 351 km (355 km in 2012) and 84% (75%), those for 96-hour forecasts were 483 km (501 km in 2012) and 81% (72%), and those for 120-hour forecasts were 630 km (647 km in 2012) 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 2013

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)
STS	Sonamu	(1301)	100	14	141	100	10	250	100	6	352	100	2	370	-	0	-
TS	Shanshan	(1302)	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
TS	Yagi	(1303)	27	11	157	0	7	296	33	3	426	-	0	-	-	0	-
TS	Leepi	(1304)	100	8	174	100	4	352	-	0	-	-	0	-	-	0	-
TS	Bebinca	(1305)	40	10	139	60	5	204	0	1	296	-	0	-	-	0	-
STS	Rumbia	(1306)	50	12	139	25	8	252	25	4	389	-	0	-	-	0	-
TY	Soulik	(1307)	95	20	138	100	16	256	100	12	378	100	8	509	100	4	695
TS	Cimaron	(1308)	33	3	130	-	0	-	-	0	-	-	0	-	-	0	-
STS	Jebi	(1309)	100	10	132	100	6	204	100	2	343	-	0	-	-	0	-
TS	Mangkhut	(1310)	100	2	139	-	0	-	-	0	-	-	0	-	-	0	-
TY	Utor	(1311)	63	19	133	73	15	222	73	11	313	71	7	487	100	3	695
STS	Trami	(1312)	73	15	142	82	11	219	100	7	362	100	3	469	-	0	-
STS	Pewa	(1313)	73	22	134	67	18	235	57	14	329	80	10	489	50	6	671
TS	Unala	(1314)	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
STS	Kong-rey	(1315)	100	11	147	100	7	257	67	3	333	-	0	-	-	0	-
TS	Yutu	(1316)	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
STS	Toraji	(1317)	60	5	157	0	1	296	-	0	-	-	0	-	-	0	-
TY	Man-yi	(1318)	80	10	143	83	6	287	100	2	463	-	0	-	-	0	-
TY	Usagi	(1319)	82	22	130	78	18	210	79	14	296	100	10	430	100	6	556
STS	Pabuk	(1320)	95	19	138	100	15	251	91	11	347	57	7	476	67	3	648
TY	Wutip	(1321)	82	11	131	57	7	204	0	3	296	-	0	-	-	0	-
TS	Sepat	(1322)	100	7	147	100	3	333	-	0	-	-	0	-	-	0	-
TY	Fitow	(1323)	91	22	132	100	18	219	100	14	340	100	10	583	100	6	826
TY	Danas	(1324)	87	15	143	91	11	273	86	7	400	0	3	494	-	0	-
TY	Nari	(1325)	90	21	131	71	17	217	92	13	332	100	9	461	100	5	556
TY	Wipha	(1326)	100	19	146	93	15	252	80	10	372	33	6	482	0	2	695
TY	Francisco	(1327)	97	36	141	100	31	229	100	27	329	100	23	494	95	19	599
TY	Lekima	(1328)	89	19	151	87	15	279	100	11	409	86	7	519	0	3	695
TY	Krosa	(1329)	78	18	144	57	14	243	70	10	350	50	6	444	0	2	556
TY	Haiyan	(1330)	64	25	138	81	21	259	82	17	389	62	13	444	44	9	556
TS	Podul	(1331)	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
Annual Mean (Total)			82	406	140	82	299	243	84	202	351	81	124	483	75	68	630

* 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 2013. 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 13.6 hPa (12.8 hPa in 2012) and 6.4 m/s (5.7 m/s). For 48-hour forecasts, the corresponding values were 21.4 hPa (17.5 hPa in 2012) and 9.4 m/s (7.5 m/s), while those for 72-hour forecasts were 23.7 hPa (20.2 hPa in 2012) and 10.4 m/s (9.6 m/s).

Table 4.3 Mean intensity errors of 24-, 48- and 72-hour operational central pressure forecasts for each TC forming in 2013

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.
STS	Sonamu	(1301)	1.0	1.9	14	3.4	4.2	10	1.3	4.2	6
TS	Shanshan	(1302)	-	-	0	-	-	0	-	-	0
TS	Yagi	(1303)	-4.5	5.6	11	-7.3	9.1	7	-9.3	10.1	3
TS	Leepi	(1304)	-2.7	3.2	8	-5.0	5.1	4	-	-	0
TS	Bebinca	(1305)	3.4	4.2	10	2.0	2.4	5	2.0	2.0	1
STS	Rumbia	(1306)	1.0	3.7	12	2.5	5.5	8	-0.7	4.0	4
TY	Soulik	(1307)	-2.5	19.2	20	-2.7	26.4	16	-14.9	28.9	12
TS	Cimaron	(1308)	-2.7	2.8	3	-	-	0	-	-	0
STS	Jebi	(1309)	-0.5	1.6	10	4.0	4.6	6	2.5	3.5	2
TS	Mangkhut	(1310)	1.0	1.4	2	-	-	0	-	-	0
TY	Utor	(1311)	-8.9	19.0	19	-15.5	26.8	15	-24.6	31.3	11
STS	Trami	(1312)	4.9	7.8	15	8.0	8.6	11	9.9	12.8	7
STS	Pewa	(1313)	-8.7	10.2	22	-14.0	16.7	18	-16.4	19.9	14
TS	Unala	(1314)	-	-	0	-	-	0	-	-	0
STS	Kong-rey	(1315)	-8.8	12.4	11	-10.0	14.7	7	-19.3	21.9	3
TS	Yutu	(1316)	-	-	0	-	-	0	-	-	0
STS	Toraji	(1317)	6.4	6.8	5	5.0	5.0	1	-	-	0
TY	Man-yi	(1318)	1.0	5.5	10	5.0	8.7	6	0.0	5.0	2
TY	Usagi	(1319)	8.2	19.6	22	17.5	33.0	18	21.4	35.1	14
STS	Pabuk	(1320)	-0.3	3.0	19	-2.0	3.7	15	-5.0	5.4	11
TY	Wutip	(1321)	4.5	12.0	11	4.7	20.7	7	5.3	15.2	3
TS	Sepat	(1322)	2.9	3.2	7	5.3	5.4	3	-	-	0
TY	Fitow	(1323)	-5.3	7.6	22	-9.8	11.1	18	-12.2	13.4	14
TY	Danas	(1324)	6.5	19.2	15	24.5	30.9	11	22.9	32.6	7
TY	Nari	(1325)	-3.0	9.8	21	-8.4	17.9	17	-8.6	20.2	13
TY	Wipha	(1326)	4.1	12.0	19	11.0	16.5	15	10.5	15.6	10
TY	Francisco	(1327)	1.7	12.5	36	-1.8	18.0	31	-5.7	16.6	27
TY	Lekima	(1328)	16.7	23.9	19	28.7	38.2	15	25.0	35.4	11
TY	Krosa	(1329)	-9.1	11.6	18	-12.4	16.9	14	-18.1	24.2	10
TY	Haiyan	(1330)	-1.9	23.6	25	6.7	34.6	21	6.2	35.4	17
TS	Podul	(1331)	-	-	0	-	-	0	-	-	0
Annual Mean (Total)			0.0	13.6	406	1.1	21.4	299	-2.0	23.7	202

Figure 4.3 shows a histogram of maximum wind speed errors for 24-hour forecasts. Approximately 54% (62% in 2012) of 24-hour forecasts had errors of less than ±3.75 m/s, with figures of ±6.25 m/s for 59% (68%) of 48-hour forecasts and ±6.25 m/s for 49% (55%) of 72-hour forecasts.

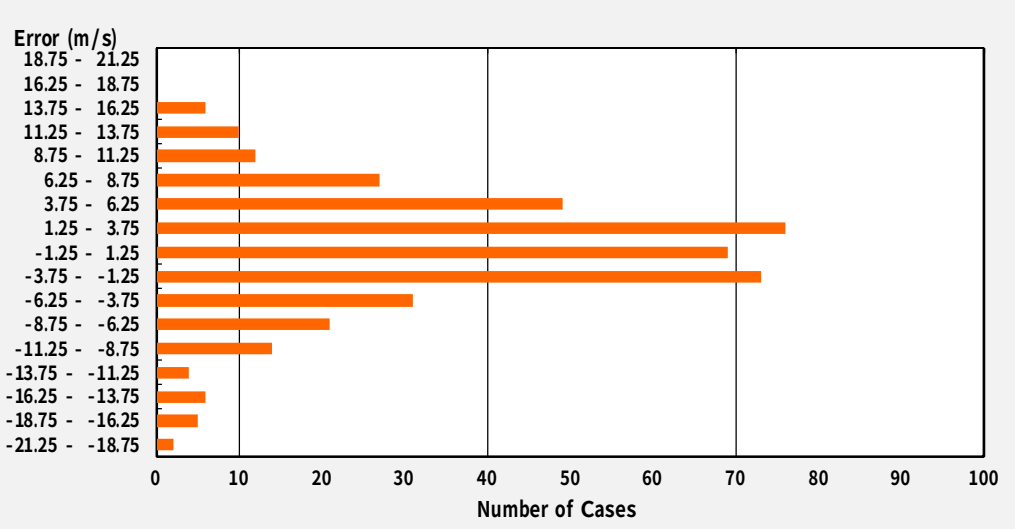


Figure 4.3 Histogram of 24-hour forecast maximum wind speed errors in 2013 (Histograms for 48-, 72-, 96- and 120-hour forecasts are included on the DVD provided with this report).

4.2 Verification of Numerical Models (GSM, TEPS)

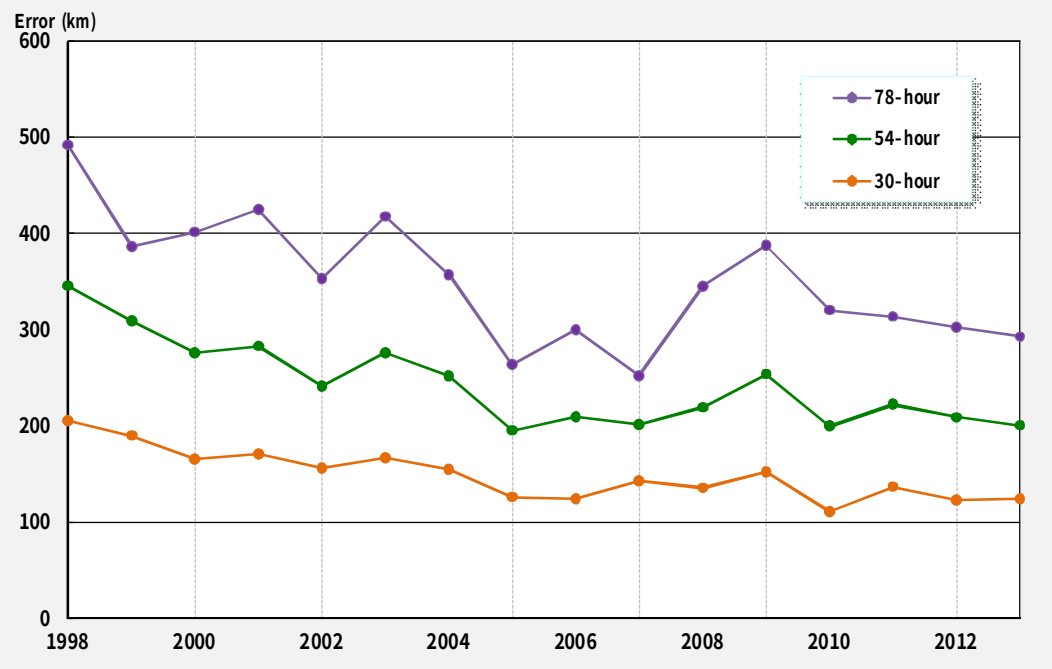


Figure 4.4 GSM annual mean position errors since 1998

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 2013, the annual mean errors for 30-, 54- and 78-hour* predictions were 124 km (123 km in 2012), 201 km (209 km) and 293 km (303 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 2013. The number of samples is given in parentheses.

Tropical Cyclone			T=18		T=30		T=42		T=54		T=66		T=78	
STS	SONAMU	(1301)	91.2	(18)	110.1	(14)	127.5	(11)	170.3	(9)	231.2	(7)	279.5	(5)
TS	SHANSHAN	(1302)	123.1	(5)	95.3	(2)	-	(-)	-	(-)	-	(-)	-	(-)
TS	YAGI	(1303)	114.9	(15)	173.0	(13)	285.8	(11)	463.4	(9)	627.0	(7)	745.8	(5)
TS	LEEPI	(1304)	89.3	(14)	108.0	(12)	105.0	(10)	136.5	(8)	168.4	(6)	205.4	(4)
TS	BEBINCA	(1305)	95.7	(15)	173.0	(13)	258.4	(11)	372.0	(9)	443.3	(4)	573.8	(2)
STS	RUMBIA	(1306)	95.4	(17)	158.9	(14)	243.5	(12)	308.1	(9)	342.4	(6)	411.6	(4)
TY	SOULIK	(1307)	61.8	(25)	80.4	(23)	96.4	(21)	114.1	(19)	124.2	(17)	120.6	(15)
TS	CIMARON	(1308)	64.0	(4)	98.3	(1)	-	(-)	-	(-)	-	(-)	-	(-)
STS	JEBI	(1309)	76.4	(15)	103.4	(13)	103.4	(11)	110.0	(9)	127.3	(7)	148.2	(5)
TS	MANGKHUT	(1310)	121.9	(9)	177.8	(7)	228.5	(5)	292.7	(3)	293.2	(1)	-	(-)
TY	UTOR	(1311)	61.7	(23)	98.7	(21)	136.8	(19)	162.4	(17)	198.8	(15)	249.4	(13)
STS	TRAMI	(1312)	117.2	(20)	142.4	(18)	149.5	(16)	139.8	(14)	122.2	(12)	131.8	(10)
STS	PEWA	(1313)	84.2	(26)	108.8	(24)	142.5	(22)	185.5	(20)	250.2	(18)	319.1	(16)
TS	UNALA	(1314)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
STS	KONG-REY	(1315)	105.8	(19)	131.8	(17)	146.3	(15)	189.4	(13)	239.1	(11)	287.5	(9)
TS	YUTU	(1316)	116.3	(11)	168.0	(9)	284.9	(7)	429.5	(5)	336.2	(3)	271.9	(1)
STS	TORAJI	(1317)	75.0	(10)	90.5	(8)	125.2	(6)	157.7	(4)	408.9	(2)	-	(-)
TY	MAN-YI	(1318)	91.2	(14)	161.2	(12)	108.4	(10)	101.6	(8)	157.4	(6)	324.6	(4)
TY	USAGI	(1319)	85.6	(25)	114.3	(23)	135.3	(21)	148.0	(19)	183.8	(17)	248.1	(15)
STS	PABUK	(1320)	119.2	(27)	122.0	(25)	143.1	(23)	174.6	(21)	207.3	(19)	261.7	(17)
TY	WUTIP	(1321)	92.2	(17)	135.5	(15)	210.6	(13)	297.6	(11)	394.3	(9)	518.3	(7)
TS	SEPAT	(1322)	73.7	(11)	93.5	(9)	142.2	(7)	160.1	(5)	255.9	(3)	167.7	(1)
TY	FITOW	(1323)	79.6	(28)	119.0	(26)	153.5	(24)	222.4	(22)	303.1	(20)	352.9	(18)
TY	DANAS	(1324)	77.1	(23)	99.2	(21)	132.4	(19)	166.5	(17)	214.7	(15)	338.0	(13)
TY	NARI	(1325)	76.6	(25)	114.7	(23)	148.4	(21)	188.0	(19)	238.7	(17)	317.8	(15)
TY	WIPHA	(1326)	77.3	(26)	92.2	(24)	120.8	(22)	153.1	(20)	188.1	(18)	241.6	(16)
TY	FRANCISCO	(1327)	72.8	(39)	101.4	(37)	132.3	(35)	172.1	(33)	213.2	(31)	247.4	(29)
TY	LEKIMA	(1328)	84.7	(24)	100.6	(22)	132.3	(20)	140.7	(18)	141.9	(16)	167.7	(14)
TY	KROSA	(1329)	107.3	(28)	168.3	(26)	231.7	(24)	311.9	(22)	418.3	(18)	479.1	(14)
TY	HAIYAN	(1330)	95.9	(27)	159.7	(25)	207.1	(23)	256.7	(22)	300.5	(19)	354.5	(18)
TS	PODUL	(1331)	149.7	(10)	225.5	(8)	232.2	(5)	287.0	(3)	380.6	(2)	341.5	(1)
Annual Mean (Total)			89.9	(570)	124.1	(505)	158.6	(444)	200.8	(388)	243.8	(326)	293.0	(271)

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 45% (46% in 2012), 55% (57%), 63% (63%) and 63% (64%) for 18-, 30-, 54- and

78-hour predictions, respectively.

About 70% (70% in 2012) of 30-hour predictions had errors of less than 150 km, while 83% (81%) of 54-hour predictions had errors of less than 300 km, and 80% (82%) 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 31 TCs forming in 2013 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	91.9	(355)	78.5	(132)	99.2	(83)	89.9	(570)
	PER	151.8	(355)	165.0	(132)	217.4	(83)	164.4	(570)
	IMPROV	39.4	%	52.5	%	54.4	%	45.3	%
T=30	GSM	128.5	(313)	102.2	(119)	141.0	(73)	124.1	(505)
	PER	248.4	(313)	270.5	(119)	407.9	(73)	276.6	(505)
	IMPROV	48.3	%	62.2	%	65.4	%	55.1	%
T=42	GSM	166.2	(268)	132.9	(111)	170.9	(65)	158.6	(444)
	PER	359.2	(268)	406.8	(111)	583.2	(65)	403.9	(444)
	IMPROV	53.7	%	67.3	%	70.7	%	60.7	%
T=54	GSM	209.2	(231)	177.2	(100)	208.4	(57)	200.8	(388)
	PER	499.6	(231)	515.6	(100)	742.6	(57)	539.4	(388)
	IMPROV	58.1	%	65.6	%	71.9	%	62.8	%
T=66	GSM	243.7	(195)	215.3	(83)	293.5	(48)	243.8	(326)
	PER	635.8	(195)	583.2	(83)	882.3	(48)	658.7	(326)
	IMPROV	61.7	%	63.1	%	66.7	%	63.0	%
T=78	GSM	281.0	(159)	279.0	(68)	358.0	(44)	293.0	(271)
	PER	782.4	(159)	726.5	(68)	864.6	(44)	781.7	(271)
	IMPROV	64.1	%	61.6	%	58.6	%	62.5	%

2) Central Pressure and Maximum Wind Speed

The mean errors of 30-, 54- and 78-hour GSM central pressure predictions in 2013 were +14.2 hPa (+10.3 hPa in 2012), +16.9 hPa (+11.5 hPa) and +18.5 hPa (+13.8 hPa), respectively. Their root mean square errors (RMSEs) were 23.8 hPa (19.7 hPa in 2012) for 30-hour predictions, 28.6 hPa (22.2 hPa) for 54-hour predictions and 31.9 hPa (26.1 hPa) for 78-hour predictions. The biases for 30-, 54- and 78-hour maximum wind speed predictions were -9.1 m/s (-6.4 m/s in 2012) with a RMSE of 12.7 m/s (9.7 m/s), -9.8 m/s (-6.3 m/s) with a RMSE of 14.8 m/s (10.9 m/s) and -9.9 m/s (-6.9 m/s) with a RMSE of 16.1 m/s (12.8 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.

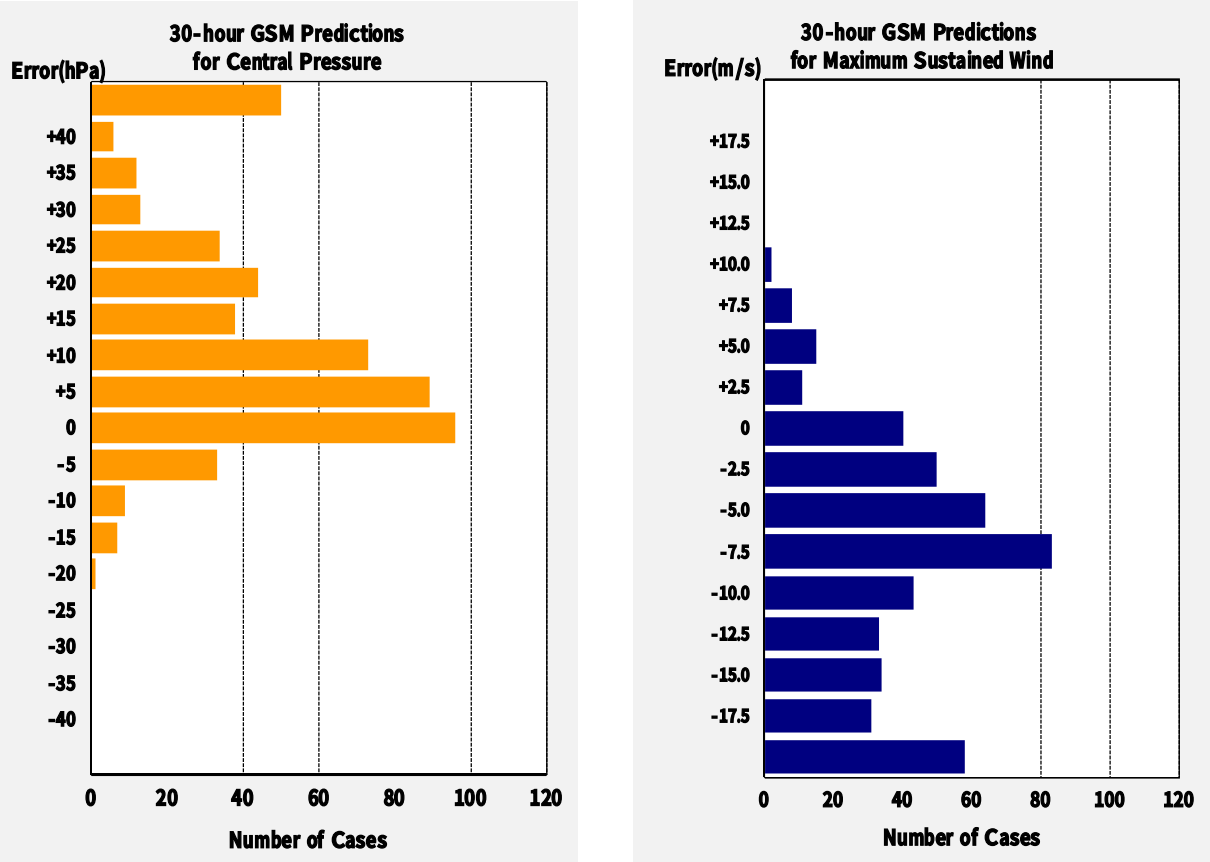


Figure 4.5 Error distribution of GSM 30-hour intensity predictions in 2013.
The figure on the left shows error distribution for central pressure, while the one on the right shows that for maximum wind speed (the error distributions of 54- and 78-hour predictions are included on the DVD provided with 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 138 km (124 km with the GSM), 216 km (201 km), 303 km (293 km), 409 km and 480 km, respectively.

Table 4.6 Mean position errors (km) of TEPS ensemble mean forecasts for each TC forming in 2013. The number of samples is given in parentheses.

Tropical Cyclone			T=30		T=54		T=78		T=102		T=126	
STS	SONAMU	(1301)	146.3	(14)	156.4	(8)	268.8	(4)	-	(-)	-	(-)
TS	SHANSHAN	(1302)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TS	YAGI	(1303)	195.0	(12)	514.4	(8)	841.0	(4)	-	(-)	-	(-)
TS	LEEPI	(1304)	101.2	(12)	124.1	(8)	240.2	(4)	-	(-)	-	(-)
TS	BEBINCA	(1305)	207.9	(13)	480.0	(7)	588.5	(1)	-	(-)	-	(-)
STS	RUMBIA	(1306)	200.4	(14)	413.9	(8)	634.8	(1)	-	(-)	-	(-)
TY	SOULIK	(1307)	78.2	(23)	92.4	(19)	123.2	(15)	190.7	(11)	327.0	(7)
TS	CIMARON	(1308)	60.8	(2)	-	(-)	-	(-)	-	(-)	-	(-)
STS	JEBI	(1309)	118.3	(12)	115.0	(7)	145.4	(3)	-	(-)	-	(-)
TS	MANGKHUT	(1310)	217.6	(6)	-	(-)	-	(-)	-	(-)	-	(-)
TY	UTOR	(1311)	134.8	(21)	256.4	(17)	441.2	(12)	615.3	(8)	836.4	(3)
STS	TRAMI	(1312)	135.6	(17)	142.5	(13)	131.3	(9)	157.9	(5)	94.9	(1)
STS	PEWA	(1313)	118.6	(24)	201.9	(20)	306.6	(16)	398.3	(12)	529.9	(8)
TS	UNALA	(1314)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
STS	KONG-REY	(1315)	155.1	(17)	223.2	(13)	371.7	(6)	466.5	(3)	-	(-)
TS	YUTU	(1316)	183.0	(7)	516.7	(3)	-	(-)	-	(-)	-	(-)
STS	TORAJI	(1317)	111.5	(8)	215.3	(4)	-	(-)	-	(-)	-	(-)
TY	MAN-YI	(1318)	140.0	(14)	82.2	(10)	306.3	(6)	874.6	(2)	-	(-)
TY	USAGI	(1319)	122.6	(24)	167.3	(20)	256.3	(16)	313.1	(12)	257.2	(8)
STS	PABUK	(1320)	118.5	(26)	166.9	(22)	243.6	(18)	321.9	(14)	329.0	(10)
TY	WUTIP	(1321)	147.5	(16)	248.6	(12)	374.0	(8)	523.1	(4)	-	(-)
TS	SEPAT	(1322)	91.1	(9)	174.0	(5)	385.2	(1)	-	(-)	-	(-)
TY	FITOW	(1323)	149.9	(27)	264.7	(23)	375.8	(19)	341.0	(14)	375.0	(10)
TY	DANAS	(1324)	109.5	(21)	176.5	(17)	349.8	(13)	766.0	(9)	1111.9	(5)
TY	NARI	(1325)	137.2	(23)	226.0	(19)	361.0	(15)	523.1	(11)	747.3	(7)
TY	WIPHA	(1326)	104.8	(24)	175.6	(20)	261.3	(16)	381.3	(12)	465.6	(8)
TY	FRANCISCO	(1327)	111.2	(37)	179.3	(33)	270.3	(29)	328.8	(25)	341.3	(21)
TY	LEKIMA	(1328)	110.3	(22)	150.2	(18)	173.6	(14)	366.6	(10)	684.9	(6)
TY	KROSA	(1329)	173.6	(26)	315.2	(21)	390.3	(13)	585.3	(10)	804.6	(2)
TY	HAIYAN	(1330)	173.4	(25)	288.0	(22)	351.5	(16)	440.4	(13)	523.8	(9)
TS	PODUL	(1331)	273.5	(9)	291.2	(3)	395.3	(1)	-	(-)	-	(-)
All Mean (Total)			137.8	(505)	216.3	(380)	303.3	(260)	408.9	(175)	479.5	(105)

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.

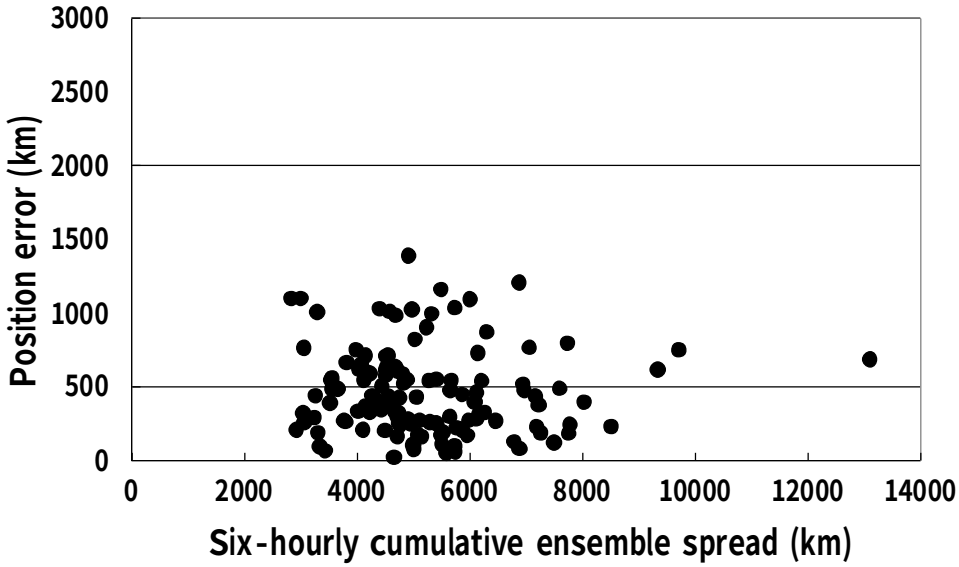


Figure 4.6 Relationship between six-hourly cumulative ensemble spread in TC position forecasts (km) and ensemble mean forecast position errors (km) in 126-hour predictions in 2013.

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. However, the A shows larger position errors compared to B and C. To improve the accuracy of forecasts, TEPS needs to be improved to give the better reliability information on the typhoon track forecast.

Table 4.7 Ensemble mean forecast position errors (km) in 2013 classified with six-hourly cumulative ensemble spread at each forecast time. The number of samples is given in parentheses.

	Reliability Index					
Time	A		B		C	
T=30	127.5	(151)	133.3	(311)	172.6	(73)
T=54	221.7	(141)	219.0	(215)	218.9	(54)
T=78	301.5	(126)	328.1	(143)	385.7	(19)
T=102	406.0	(99)	408.6	(88)	404.3	(10)
T=126	495.4	(65)	423.6	(57)	570.8	(4)

Appendices

RSMC Tropical Cyclone Best Track Data in 2013

Appendix 1

Sonamu (1301)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jan.	01/00	4.1	141.7	1006	-	0.0	TD
	01/06	4.4	139.5	1004	-	0.0	TD
	01/12	4.6	137.2	1006	-	0.0	TD
	01/18	5.3	135.0	1006	-	0.0	TD
	02/00	6.1	132.6	1006	-	0.0	TD
	02/06	6.7	130.4	1004	-	0.0	TD
	02/12	7.4	128.4	1006	-	0.5	TD
	02/18	8.0	126.2	1004	-	1.0	TD
	03/00	8.4	123.7	1006	-	1.5	TD
	03/06	8.4	121.6	1004	-	1.5	TD
	03/12	8.6	119.6	1002	35	1.5	TS
	03/18	8.5	117.9	1002	35	2.0	TS
	04/00	8.4	116.2	1002	35	2.5	TS
	04/06	8.2	115.4	998	40	2.5	TS
	04/12	8.1	114.2	996	40	2.5	TS
	04/18	8.0	113.0	992	45	2.5	TS
	05/00	7.9	112.2	990	50	2.5	STS
	05/06	7.7	111.6	990	50	2.5	STS
	05/12	7.5	111.1	990	50	2.0	STS
	05/18	7.3	110.4	990	50	2.0	STS
	06/00	7.3	109.9	990	50	2.0	STS
	06/06	7.2	109.3	994	45	2.0	TS
	06/12	7.1	108.8	994	45	2.0	TS
	06/18	6.9	108.3	994	45	2.0	TS
	07/00	6.5	108.1	994	45	2.0	TS
	07/06	6.2	108.1	996	40	2.0	TS
	07/12	6.0	108.2	998	35	2.0	TS
	07/18	5.8	108.2	1000	35	2.0	TS
	08/00	5.6	108.5	1004	-	2.0	TD
	08/06	5.4	109.0	1006	-	2.0	TD
	08/12	5.0	109.4	1008	-	2.0	TD
	08/18	4.6	109.8	1006	-	-	TD
	09/00	4.3	110.4	1006	-	-	TD
	09/06	4.0	110.7	1006	-	-	TD
	09/12	3.6	111.2	1006	-	-	TD
	09/18	3.2	111.5	1006	-	-	TD
	10/00	3.3	112.0	1008	-	-	TD
	10/06						Dissip.

Shanshan (1302)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Feb.	18/06	5.0	131.0	1002	-	0.5	TD
	18/12	5.6	129.3	1002	-	0.5	TD
	18/18	5.9	127.5	1002	-	1.0	TD
	19/00	5.7	126.6	1004	-	0.5	TD
	19/06	5.3	125.4	1004	-	0.0	TD
	19/12	5.9	124.2	1004	-	0.0	TD
	19/18	7.1	122.8	1004	-	0.0	TD
	20/00	7.4	121.3	1004	-	0.5	TD
	20/06	7.5	120.7	1002	-	1.5	TD
	20/12	7.5	120.0	1004	-	1.5	TD
	20/18	7.5	118.0	1004	-	1.5	TD
	21/00	7.7	115.5	1004	-	1.5	TD
	21/06	7.0	112.7	1004	-	0.5	TD
	21/12	6.5	111.6	1004	-	1.0	TD
	21/18	5.9	110.3	1002	35	1.5	TS
	22/00	5.4	110.1	1002	35	2.0	TS
	22/06	5.2	109.9	1002	35	2.0	TS
	22/12	5.0	109.7	1004	-	2.0	TD
	22/18	4.7	109.6	1004	-	2.0	TD
	23/00	4.2	109.3	1006	-	2.0	TD
	23/06						Dissip.

Yagi (1303)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun.	06/18	12.9	128.5	1006	-	0.5	TD
	07/00	13.3	129.0	1006	-	1.0	TD
	07/06	13.8	129.4	1004	-	1.0	TD
	07/12	14.6	129.6	1004	-	1.0	TD
	07/18	15.5	129.5	1004	-	1.0	TD
	08/00	16.4	129.4	1004	-	1.5	TD
	08/06	17.0	129.8	1002	-	1.5	TD
	08/12	17.8	130.1	1000	35	2.0	TS
	08/18	18.7	130.5	998	35	2.5	TS
	09/00	19.7	131.0	996	35	2.5	TS
	09/06	20.5	131.5	994	35	2.5	TS
	09/12	20.9	132.0	994	35	2.5	TS
	09/18	21.3	132.6	992	40	2.5	TS
	10/00	22.3	133.3	992	40	3.0	TS
	10/06	23.4	134.1	992	40	3.0	TS
	10/12	24.4	134.9	990	45	3.0	TS
	10/18	25.9	135.7	990	45	3.0	TS
	11/00	27.6	136.2	990	45	3.0	TS
	11/06	29.1	136.9	990	45	3.0	TS
	11/12	29.9	136.8	994	40	3.0	TS
	11/18	30.5	136.8	996	35	3.0	TS
	12/00	31.0	137.2	998	35	3.0	TS
	12/06	31.1	137.9	1000	-	2.5	L
	12/12	31.3	138.7	1000	-	2.0	L
	12/18	31.8	139.5	1002	-	2.0	L
	13/00	32.4	139.2	1004	-	-	L
	13/06	32.2	139.5	1004	-	-	L
	13/12	31.6	139.2	1006	-	-	L
	13/18	31.1	139.3	1006	-	-	L
	14/00	31.0	139.2	1008	-	-	L
	14/06	30.8	139.4	1008	-	-	L
	14/12	30.7	139.5	1010	-	-	L
	14/18	30.7	139.7	1008	-	-	L
	15/00	30.7	140.0	1010	-	-	L
	15/06	30.7	140.3	1008	-	-	L
	15/12	30.6	141.2	1008	-	-	L
	15/18	30.8	141.7	1006	-	-	L
	16/00	30.8	141.9	1006	-	-	L
	16/06	31.3	142.8	1004	-	-	L
	16/12						Dissip.

Leepi (1304)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun.	16/06	12.0	128.2	1004	-	0.0	TD
	16/12	12.6	127.6	1004	-	0.5	TD
	16/18	12.9	127.1	1002	-	1.0	TD
	17/00	13.3	126.9	1002	-	1.5	TD
	17/06	13.9	126.8	1000	-	1.5	TD
	17/12	14.5	126.6	1000	-	1.5	TD
	17/18	15.5	126.6	998	-	1.5	TD
	18/00	16.6	126.6	998	35	2.0	TS
	18/06	17.7	126.6	996	35	2.0	TS
	18/12	18.9	126.2	996	35	2.0	TS
	18/18	19.7	125.7	994	40	2.5	TS
	19/00	21.0	125.3	994	40	2.5	TS
	19/06	22.3	125.2	994	40	2.5	TS
	19/12	24.1	125.4	994	40	2.5	TS
	19/15	24.6	125.3	994	40	-	TS
	19/18	25.2	124.9	994	40	2.5	TS
	19/21	26.1	124.9	994	40	-	TS
	20/00	26.8	124.8	994	40	2.5	TS
	20/06	28.5	125.2	994	40	2.5	TS
	20/12	30.0	125.7	996	35	2.0	TS
	20/18	31.0	126.3	998	35	2.0	TS
	20/21	31.8	127.0	998	35	-	TS
	21/00	32.0	127.0	1002	-	1.5	L
	21/06	32.8	129.9	1002	-	-	L
	21/12	32.4	135.7	1004	-	-	L
	21/18	32.7	140.1	1000	-	-	L
	22/00	33.4	145.9	1000	-	-	L
	22/06	34.2	150.1	1000	-	-	L
	22/12	35.0	153.5	1000	-	-	L
	22/18	36.6	157.2	1000	-	-	L
	23/00	38.1	161.0	1000	-	-	L
	23/06	43.1	170.4	1004	-	-	L
	23/12	44.5	174.0	1004	-	-	L
	23/18	46.0	177.9	1008	-	-	L
	24/00						Dissip.

Bebinca (1305)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun.	19/18	14.8	116.9	1002	-	0.5	TD
	20/00	15.7	117.4	1002	-	1.0	TD
	20/06	16.4	117.6	1000	-	1.5	TD
	20/12	17.2	117.4	1000	-	1.5	TD
	20/18	17.6	116.8	998	35	2.0	TS
	21/00	18.0	116.2	998	35	2.0	TS
	21/06	18.4	115.5	996	35	2.0	TS
	21/12	18.8	114.3	996	35	2.0	TS
	21/18	19.2	112.8	994	35	2.0	TS
	22/00	19.2	111.4	990	40	2.0	TS
	22/06	19.1	110.2	990	40	2.0	TS
	22/12	19.0	108.7	990	40	2.0	TS
	22/18	19.2	107.8	992	40	2.0	TS
	23/00	19.3	107.3	992	35	2.0	TS
	23/06	19.8	107.0	994	35	2.0	TS
	23/12	20.4	106.6	994	35	2.0	TS
	23/18	20.7	106.4	996	35	2.0	TS
	24/00	21.0	106.4	998	35	2.0	TS
	24/06	21.6	106.6	1000	-	2.0	TD
	24/12						Dissip.

Rumbia (1306)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun.	27/00	9.1	132.5	1008	-	0.0	TD
	27/06	9.1	132.0	1006	-	0.5	TD
	27/12	9.0	131.5	1006	-	1.0	TD
	27/18	8.9	130.5	1004	-	1.0	TD
	28/00	9.5	129.3	1006	-	1.0	TD
	28/06	10.0	128.5	1006	-	1.5	TD
	28/12	10.3	128.0	1002	35	2.0	TS
	28/18	11.5	126.2	1002	35	2.0	TS
	29/00	11.7	125.0	1002	35	2.0	TS
	29/06	12.9	124.1	1002	35	2.0	TS
	29/12	13.7	122.8	1002	35	2.0	TS
	29/18	13.9	121.1	1000	35	2.0	TS
	30/00	14.6	119.7	1000	35	2.5	TS
	30/06	15.3	118.6	996	40	2.5	TS
	30/12	16.4	117.2	994	40	3.0	TS
	30/18	17.5	115.6	990	45	3.0	TS
Jul.	01/00	18.3	113.9	990	45	3.0	TS
	01/06	19.0	112.6	985	50	3.5	STS
	01/12	19.8	111.6	985	50	3.5	STS
	01/18	20.6	110.5	990	45	3.5	TS
	02/00	21.4	110.0	992	45	3.0	TS
	02/06	23.1	109.0	996	35	3.0	TS
	02/12	24.0	108.4	1000	-	2.5	TD
	02/18						Dissip.

Soulik (1307)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul.	07/00	19.0	151.0	1010	-	1.0	TD
	07/06	19.1	149.3	1010	-	1.5	TD
	07/12	19.1	147.9	1010	-	1.5	TD
	07/18	18.9	146.5	1006	-	2.0	TD
	08/00	18.9	145.4	1002	35	2.5	TS
	08/06	19.0	143.9	994	45	3.0	TS
	08/12	19.2	142.7	985	50	3.5	STS
	08/18	19.4	141.5	975	60	4.0	STS
	09/00	19.6	140.4	970	65	4.0	TY
	09/06	20.0	139.4	955	80	5.0	TY
	09/12	20.3	138.1	945	85	6.0	TY
	09/18	20.7	137.1	935	90	6.0	TY
	10/00	21.1	135.8	925	100	6.5	TY
	10/06	21.4	134.8	925	100	6.5	TY
	10/12	21.8	133.5	925	100	6.5	TY
	10/18	21.9	132.3	930	95	6.5	TY
	11/00	22.1	130.9	935	90	5.5	TY
	11/06	22.4	129.8	940	90	5.5	TY
	11/12	22.4	128.4	940	90	5.5	TY
	11/15	22.5	127.7	940	90	-	TY
	11/18	22.6	127.0	940	90	5.5	TY
	11/21	22.6	126.5	940	90	-	TY
	12/00	22.8	125.9	950	80	5.0	TY
	12/03	23.0	125.4	950	80	-	TY
	12/06	23.2	124.9	950	80	4.5	TY
	12/09	23.6	124.3	950	80	-	TY
	12/12	23.9	123.9	950	80	4.5	TY
	12/15	24.3	123.1	945	85	-	TY
	12/18	24.8	122.3	950	80	4.5	TY
	12/21	24.8	121.4	960	75	-	TY
	13/00	25.0	121.2	970	60	4.5	STS
	13/06	25.9	119.9	980	55	4.5	STS
	13/12	26.2	118.3	990	50	4.0	STS
	13/18	27.0	117.2	994	40	3.5	TS
	14/00	28.0	116.2	998	-	3.0	TD
	14/06	29.2	115.8	998	-	-	TD
	14/12	30.7	115.7	1000	-	-	TD
	14/18						Dissip.

Cimaron (1308)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul.	15/06	14.0	126.9	1006	-	0.5	TD
	15/12	14.2	126.2	1008	-	1.0	TD
	15/18	14.6	125.6	1006	-	1.5	TD
	16/00	14.8	125.0	1006	-	1.5	TD
	16/06	15.6	124.4	1004	-	1.5	TD
	16/12	16.4	123.8	1004	-	1.5	TD
	16/18	17.2	123.2	1004	-	1.5	TD
	17/00	18.7	122.1	1002	35	2.0	TS
	17/06	19.3	120.9	1002	35	2.0	TS
	17/12	19.7	120.0	1002	35	2.0	TS
	17/18	20.7	119.0	1000	40	2.5	TS
	18/00	21.6	117.9	1000	40	2.5	TS
	18/06	22.4	117.5	1000	40	2.5	TS
	18/12	22.9	117.6	1002	35	2.0	TS
	18/18	23.5	117.9	1004	-	2.0	TD
	19/00						Dissip.

Jebi (1309)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul.	28/18	13.1	123.3	1006	-	0.5	TD
	29/00	13.2	122.4	1008	-	0.5	TD
	29/06	13.4	121.6	1006	-	0.5	TD
	29/12	13.6	120.9	1006	-	0.5	TD
	29/18	13.7	120.1	1004	-	1.0	TD
	30/00	13.8	119.5	1004	-	1.0	TD
	30/06	14.0	118.4	1002	-	1.0	TD
	30/12	14.3	117.5	1002	-	1.5	TD
	30/18	14.6	117.0	1002	-	1.5	TD
	31/00	14.7	116.3	1000	35	2.0	TS
	31/06	14.8	115.7	998	35	2.0	TS
	31/12	15.1	115.0	994	35	2.0	TS
	31/18	15.3	114.5	994	35	2.0	TS
Aug.	01/00	15.6	113.8	994	35	2.0	TS
	01/06	16.1	113.5	994	35	2.0	TS
	01/12	16.4	113.2	992	40	2.0	TS
	01/18	16.8	112.8	990	40	2.5	TS
	02/00	17.7	112.5	990	40	3.0	TS
	02/06	18.8	111.8	985	50	3.0	STS
	02/12	19.7	111.1	985	50	3.0	STS
	02/18	20.3	109.4	985	50	3.5	STS
	03/00	21.0	107.9	985	50	3.5	STS
	03/06	21.6	106.5	990	40	3.0	TS
	03/12	22.0	104.5	998	-	2.5	TD
	03/18						Dissip.

Mangkhut (1310)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug.	05/00	10.7	117.7	1006	-	1.0	TD
	05/06	11.4	116.9	1004	-	1.5	TD
	05/12	12.0	115.5	1004	-	1.5	TD
	05/18	13.1	113.5	1004	-	1.5	TD
	06/00	14.0	112.8	1002	-	1.5	TD
	06/06	15.1	111.8	1002	-	1.5	TD
	06/12	15.8	110.8	998	35	1.5	TS
	06/18	17.1	109.5	996	35	2.0	TS
	07/00	18.1	108.3	994	40	2.5	TS
	07/06	18.7	106.8	992	40	3.0	TS
	07/12	19.0	106.4	994	40	3.0	TS
	07/18	19.7	105.4	996	35	2.5	TS
	08/00	20.0	104.2	1000	-	2.0	TD
	08/06						Dissip.

Utor (1311)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug.	08/12	12.1	136.6	1008	-	-	TD
	08/18	12.6	135.8	1006	-	1.0	TD
	09/00	13.3	135.0	1006	-	1.5	TD
	09/06	13.5	133.6	1004	-	2.0	TD
	09/12	13.5	132.6	1004	-	2.5	TD
	09/18	13.5	131.7	1002	35	3.0	TS
	10/00	13.6	130.6	992	45	3.5	TS
	10/06	13.9	129.2	965	70	4.0	TY
	10/12	14.0	128.2	955	80	5.0	TY
	10/18	14.2	127.0	955	80	5.0	TY
	11/00	14.5	125.9	950	85	5.0	TY
	11/06	15.1	124.8	940	90	6.0	TY
	11/12	15.5	123.5	925	105	6.5	TY
	11/18	16.1	122.2	935	95	5.5	TY
	12/00	16.7	120.8	955	75	5.0	TY
	12/06	17.2	119.2	965	70	4.5	TY
	12/12	17.9	118.0	965	70	4.5	TY
	12/18	18.0	116.5	965	70	4.5	TY
	13/00	18.3	115.2	960	70	4.5	TY
	13/06	18.8	114.1	960	70	4.5	TY
	13/12	19.2	113.5	960	70	4.5	TY
	13/18	19.6	112.9	960	70	4.5	TY
	14/00	20.6	112.2	960	70	4.5	TY
	14/06	21.6	112.0	965	65	4.5	TY
	14/12	22.0	111.3	975	60	4.0	STS
	14/18	22.5	111.2	985	45	3.5	TS
	15/00	23.1	111.0	994	35	3.0	TS
	15/06	23.7	111.0	994	35	3.0	TS
	15/12	24.2	111.2	996	-	2.5	TD
	15/18	24.5	111.4	996	-	-	TD
	16/00	24.7	111.6	996	-	-	TD
	16/06	24.8	111.5	996	-	-	TD
	16/12	24.8	111.2	996	-	-	TD
	16/18	24.7	110.8	996	-	-	TD
	17/00	24.4	110.3	996	-	-	TD
	17/06	23.9	110.1	996	-	-	TD
	17/12	23.5	109.9	996	-	-	TD
	17/18	23.2	109.6	996	-	-	TD
	18/00	23.2	109.4	998	-	-	TD
	18/06	23.1	109.1	998	-	-	TD
	18/12						Dissip.

Trami (1312)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug.	16/12	22.5	123.4	1002	-	1.5	TD
	16/18	22.0	124.0	1000	-	1.5	TD
	17/00	21.2	124.9	1000	-	1.5	TD
	17/06	20.7	125.7	998	-	1.5	TD
	17/12	20.5	126.5	1000	-	1.5	TD
	17/18	20.4	126.9	996	-	2.0	TD
	18/00	20.3	127.0	994	35	2.0	TS
	18/06	20.2	127.2	994	35	2.5	TS
	18/12	19.7	127.4	994	35	2.5	TS
	18/18	19.2	127.6	992	40	3.0	TS
	19/00	19.2	127.7	992	40	3.0	TS
	19/06	19.7	128.1	992	40	3.0	TS
	19/12	20.5	128.6	990	45	3.0	TS
	19/18	21.1	128.7	985	50	3.5	STS
	20/00	22.3	128.5	985	50	3.5	STS
	20/06	22.6	127.8	980	55	3.5	STS
	20/12	22.9	126.8	980	55	3.5	STS
	20/15	23.6	126.7	980	55	-	STS
	20/18	24.5	126.2	970	60	4.0	STS
	20/21	24.9	125.3	965	60	-	STS
	21/00	25.2	124.3	965	60	4.0	STS
	21/03	25.3	123.6	965	60	-	STS
	21/06	25.5	122.8	965	60	4.0	STS
	21/12	25.9	121.0	965	60	4.0	STS
	21/18	25.7	119.6	965	60	4.0	STS
	22/00	26.0	118.4	980	50	3.5	STS
	22/06	26.8	117.1	985	40	3.0	TS
	22/12	27.5	116.0	990	35	3.0	TS
	22/18	27.7	114.7	990	-	2.5	TD
	23/00	27.8	113.5	992	-	-	TD
	23/06	27.8	112.7	994	-	-	TD
	23/12	27.1	111.7	996	-	-	TD
	23/18	26.0	110.5	998	-	-	TD
	24/00	25.3	108.5	998	-	-	TD
	24/06	24.3	107.3	998	-	-	TD
	24/12						Dissip.

Pewa (1313)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug.	18/06	12.0	180.4	996	45	3.5	Out
	18/12	12.4	179.7	996	45	3.5	TS
	18/18	12.7	179.0	996	45	3.5	TS
	19/00	13.3	178.4	990	55	4.0	STS
	19/06	13.8	177.8	990	55	4.0	STS
	19/12	14.3	177.1	990	55	4.0	STS
	19/18	14.8	176.5	996	45	3.5	TS
	20/00	15.3	175.6	996	45	3.5	TS
	20/06	16.2	174.8	998	40	3.0	TS
	20/12	17.2	173.8	998	40	3.0	TS
	20/18	18.0	172.8	998	40	3.0	TS
	21/00	18.6	171.8	1000	35	2.5	TS
	21/06	19.4	171.2	1000	35	2.5	TS
	21/12	20.2	170.5	1004	35	2.5	TS
	21/18	21.3	170.1	1004	35	2.5	TS
	22/00	22.2	169.7	1004	35	2.5	TS
	22/06	23.2	169.6	1004	35	2.5	TS
	22/12	24.2	169.3	1004	35	2.5	TS
	22/18	25.2	168.9	1004	35	2.5	TS
	23/00	25.8	168.5	1004	35	2.5	TS
	23/06	26.4	168.5	1004	35	2.5	TS
	23/12	26.8	168.9	1004	35	2.5	TS
	23/18	27.2	169.3	1004	35	2.5	TS
	24/00	27.5	169.3	1004	35	2.5	TS
	24/06	27.9	168.8	1004	35	2.5	TS
	24/12	28.2	168.1	1004	35	2.5	TS
	24/18	28.3	167.5	1004	35	2.0	TS
	25/00	28.5	166.9	1004	-	2.0	TD
	25/06	28.7	166.2	1002	-	2.0	TD
	25/12	29.0	166.0	1004	-	2.0	TD
	25/18	29.6	165.8	1004	-	1.5	TD
	26/00	30.8	165.3	1004	-	1.5	TD
	26/06	32.0	165.3	1004	-	1.5	TD
	26/12	33.4	165.6	1004	-	1.5	TD
	26/18	35.2	165.8	1004	-	-	TD
	27/00						Dissip.

Unala (1314)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug.	19/00	17.0	182.3	1000	35	1.5	Out
	19/06	17.5	180.0	1000	35	1.5	TS
	19/12	17.5	179.2	1004	-	1.5	TD
	19/18						Dissip.

Kong-rey (1315)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug.	25/00	11.3	129.0	1004	-	1.0	TD
	25/06	12.1	128.7	1002	-	1.5	TD
	25/12	13.5	128.1	1002	-	1.5	TD
	25/18	14.8	127.0	1002	-	1.5	TD
	26/00	15.4	126.1	1002	-	2.0	TD
	26/06	16.0	125.3	1000	35	2.0	TS
	26/12	16.9	124.2	998	35	2.0	TS
	26/18	17.6	123.8	996	40	2.5	TS
	27/00	18.4	124.0	996	40	2.5	TS
	27/06	19.4	123.9	996	40	2.5	TS
	27/12	20.0	123.5	992	45	2.5	TS
	27/18	20.4	123.1	990	45	2.5	TS
	28/00	20.8	122.8	985	50	3.0	STS
	28/06	21.9	122.7	985	50	3.0	STS
	28/09	22.4	122.7	985	50	-	STS
	28/12	22.8	122.5	980	55	3.0	STS
	28/15	23.2	122.4	980	55	-	STS
	28/18	23.9	122.5	980	55	3.0	STS
	28/21	24.6	122.5	985	50	-	STS
	29/00	25.2	122.5	992	40	3.0	TS
	29/03	25.7	122.5	996	35	-	TS
	29/06	25.9	122.3	996	35	3.0	TS
	29/12	26.7	122.1	996	35	2.5	TS
	29/18	27.2	122.5	996	35	2.5	TS
	30/00	28.7	123.5	998	-	2.0	TD
	30/06	29.9	124.5	1000	-	2.0	TD
	30/12						Dissip.

Yutu (1316)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug.	29/00	29.2	169.1	1008	-	-	TD
	29/06	29.0	169.2	1008	-	-	TD
	29/12	28.9	169.2	1008	-	-	TD
	29/18	28.7	169.3	1006	-	-	TD
	30/00	28.5	169.4	1006	-	-	TD
	30/06	28.1	169.6	1004	-	-	TD
	30/12	27.7	170.4	1004	-	-	TD
	30/18	28.1	171.4	1004	-	-	TD
	31/00	28.8	172.6	1004	-	-	TD
	31/06	30.0	173.6	1004	-	-	TD
	31/12	31.1	174.6	1002	-	0.5	TD
	31/18	32.0	175.5	1002	-	1.0	TD
Sep.	01/00	32.5	176.2	1002	35	1.0	TS
	01/06	33.5	176.6	1002	35	1.5	TS
	01/12	33.6	176.8	1002	35	1.5	TS
	01/18	33.7	176.9	1002	-	1.5	TD
	02/00	33.7	177.0	1004	-	1.5	TD
	02/06	33.7	177.2	1004	-	1.5	TD
	02/12	33.5	177.3	1004	-	1.5	TD
	02/18	33.4	177.4	1004	-	1.0	TD
	03/00	33.1	177.3	1004	-	1.0	TD
	03/06	32.8	177.2	1006	-	1.0	TD
	03/12	32.3	177.0	1006	-	1.0	TD
	03/18	32.2	176.7	1008	-	1.0	TD
	04/00	32.1	176.3	1008	-	1.0	TD
	04/06	31.8	175.6	1008	-	-	TD
	04/12	31.6	174.8	1012	-	-	TD
	04/18	31.3	173.7	1012	-	-	TD
	05/00	31.1	173.0	1012	-	-	TD
	05/06	31.0	172.0	1012	-	-	TD
	05/12						Dissip.

Toraji (1317)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug.	31/00	25.6	121.5	1004	-	-	TD
	31/06	24.8	121.9	1004	-	-	TD
	31/12	24.7	122.4	1006	-	0.0	TD
	31/18	25.0	122.8	1004	-	0.5	TD
Sep.	01/00	25.3	123.3	1006	-	0.5	TD
	01/06	25.7	123.8	1004	-	1.0	TD
	01/12	26.0	124.3	1004	-	1.5	TD
	01/18	26.3	124.8	1000	35	2.0	TS
	02/00	26.6	125.5	996	40	2.5	TS
	02/06	27.2	126.1	994	45	2.5	TS
	02/12	27.7	126.6	992	45	2.5	TS
	02/18	28.1	127.1	990	45	2.5	TS
	03/00	28.6	127.5	985	50	3.0	STS
	03/06	29.4	128.2	985	50	3.0	STS
	03/12	30.0	129.2	985	50	3.0	STS
	03/15	30.5	129.8	985	50	-	STS
	03/18	31.4	130.5	985	50	3.0	STS
	03/21	31.8	131.2	996	40	-	TS
	04/00	32.9	132.8	1000	-	2.5	L
	04/06	32.9	133.5	1002	-	-	L
	04/12	32.5	134.0	1006	-	-	L
	04/18	32.8	135.9	1006	-	-	L
	05/00	33.5	136.6	1010	-	-	L
	05/06	33.9	137.7	1010	-	-	L
	05/12						Dissip.

Man-yi (1318)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep.	11/18	19.7	148.1	1008	-	1.0	TD
	12/00	20.3	146.9	1008	-	1.5	TD
	12/06	20.7	145.6	1008	-	1.5	TD
	12/12	21.0	145.0	1008	-	1.5	TD
	12/18	21.0	144.0	1004	-	1.5	TD
	13/00	22.0	142.1	998	35	2.0	TS
	13/06	23.3	140.7	994	35	2.0	TS
	13/12	23.5	140.0	994	35	2.0	TS
	13/18	23.6	138.7	990	40	2.5	TS
	14/00	24.0	137.3	990	45	3.0	TS
	14/06	25.0	136.5	985	50	3.0	STS
	14/12	26.1	135.8	985	50	3.0	STS
	14/18	27.4	135.0	985	50	3.0	STS
	15/00	28.7	134.3	980	50	3.0	STS
	15/06	30.0	134.5	975	50	3.0	STS
	15/12	31.5	135.0	960	65	3.5	TY
	15/15	32.1	135.3	960	65	-	TY
	15/18	32.9	136.0	960	65	4.0	TY
	15/21	33.9	136.9	960	65	-	TY
	15/22	34.5	137.3	965	60	-	STS
	16/00	35.3	137.7	975	60	3.5	STS
	16/03	36.3	138.9	985	50	-	STS
	16/06	38.4	141.1	985	50	3.0	STS
	16/09	40.5	143.0	985	50	-	STS
	16/12	42.0	145.0	980	-	2.5	L
	16/18	45.6	150.0	978	-	-	L
	17/00	49.1	153.9	972	-	-	L
	17/06	52.2	156.2	964	-	-	L
	17/12	55.0	156.0	964	-	-	L
	17/18	56.2	156.7	960	-	-	L
	18/00	57.2	157.5	966	-	-	L
	18/06	58.0	160.4	970	-	-	L
	18/12	59.0	161.9	976	-	-	L
	18/18	59.4	163.7	980	-	-	L
	19/00	59.7	163.0	984	-	-	L
	19/06	60.9	163.1	988	-	-	L
	19/12	59.8	164.4	996	-	-	L
	19/18	59.8	165.6	996	-	-	L
	20/00	59.5	166.7	998	-	-	L
	20/06	59.1	170.0	998	-	-	L
	20/12	58.9	168.6	998	-	-	L
	20/18						Dissip.

Usagi (1319)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep.	16/00	17.3	132.0	1006	-	0.5	TD
	16/06	17.3	132.3	1002	-	1.5	TD
	16/12	17.0	132.4	1002	-	1.5	TD
	16/18	17.0	132.1	1000	35	2.0	TS
	17/00	17.0	131.9	1000	35	2.0	TS
	17/06	17.2	131.4	998	35	2.5	TS
	17/12	17.2	131.1	994	40	2.5	TS
	17/18	17.2	130.7	990	45	3.0	TS
	18/00	17.0	130.5	985	50	3.0	STS
	18/06	17.1	130.2	980	55	4.0	STS
	18/12	17.3	129.6	970	65	4.5	TY
	18/18	17.1	128.6	960	70	5.0	TY
	19/00	16.9	128.3	950	80	5.5	TY
	19/06	17.5	128.0	925	95	6.0	TY
	19/12	18.1	127.3	915	105	7.0	TY
	19/18	18.7	126.4	910	110	7.0	TY
	20/00	19.3	125.5	910	110	7.0	TY
	20/06	19.7	124.6	910	110	7.0	TY
	20/12	20.1	123.8	910	110	6.5	TY
	20/18	20.4	122.6	915	105	6.0	TY
	21/00	20.6	121.8	920	100	6.0	TY
	21/06	20.8	120.8	925	90	5.0	TY
	21/12	21.1	119.7	930	85	5.0	TY
	21/18	21.4	118.9	935	85	5.0	TY
	22/00	21.8	117.9	935	85	5.0	TY
	22/06	22.4	116.8	935	85	5.5	TY
	22/12	22.9	115.4	940	80	5.0	TY
	22/18	23.1	113.9	975	50	4.0	STS
	23/00	23.6	112.5	990	40	4.0	TS
	23/06	24.3	111.2	996	-	3.5	TD
	23/12	24.6	110.2	998	-	-	TD
	23/18	24.9	109.4	1000	-	-	TD
	24/00	25.1	108.5	1004	-	-	TD
	24/06						Dissip.

Pabuk (1320)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep.	19/06	14.0	148.5	1004	-	0.0	TD
	19/12	14.9	149.0	1002	-	0.5	TD
	19/18	15.8	149.3	1002	-	1.0	TD
	20/00	16.9	149.7	1002	-	1.0	TD
	20/06	18.6	149.5	1002	-	1.0	TD
	20/12	19.3	148.2	1002	-	1.5	TD
	20/18	19.7	146.8	1000	-	1.5	TD
	21/00	19.7	145.9	998	-	2.0	TD
	21/06	19.8	145.2	996	35	2.5	TS
	21/12	20.0	144.7	992	40	2.5	TS
	21/18	20.6	144.1	990	40	2.5	TS
	22/00	21.3	143.3	990	45	2.5	TS
	22/06	22.0	142.7	985	50	3.0	STS
	22/12	22.5	141.9	980	50	3.0	STS
	22/18	23.2	141.6	975	50	3.0	STS
	23/00	23.8	141.6	975	50	3.5	STS
	23/06	24.8	141.2	970	55	3.5	STS
	23/12	25.1	140.8	970	55	3.5	STS
	23/18	25.3	140.5	970	55	3.5	STS
	24/00	25.8	139.9	970	55	3.5	STS
	24/06	26.2	139.4	970	55	3.5	STS
	24/12	26.7	138.9	965	60	4.0	STS
	24/18	27.5	138.7	965	60	4.0	STS
	25/00	28.4	138.8	965	60	4.0	STS
	25/06	29.3	139.0	965	60	4.0	STS
	25/12	30.2	140.1	965	60	4.0	STS
	25/18	31.0	141.6	965	60	4.0	STS
	26/00	32.2	143.5	965	60	4.0	STS
	26/06	33.8	145.2	970	60	4.0	STS
	26/12	35.0	147.2	970	60	4.0	STS
	26/18	36.9	149.8	975	60	3.5	STS
	27/00	39.9	152.7	980	-	3.5	L
	27/06	42.2	156.4	984	-	-	L
	27/12	45.0	160.0	988	-	-	L
	27/18	47.0	162.9	990	-	-	L
	28/00	47.6	163.9	996	-	-	L
	28/06	48.8	167.4	1000	-	-	L
	28/12	49.4	171.8	1002	-	-	L
	28/18	49.6	177.3	1008	-	-	L
	29/00	49.3	181.5	1012	-	-	Out

Wutip (1321)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep.	25/18	14.8	118.4	1006	-	0.0	TD
	26/00	14.7	117.6	1006	-	0.5	TD
	26/06	14.5	117.9	1004	-	0.5	TD
	26/12	15.1	118.1	1006	-	1.0	TD
	26/18	15.6	117.8	1004	-	1.5	TD
	27/00	16.2	117.4	1004	-	2.0	TD
	27/06	16.8	116.3	1000	35	2.5	TS
	27/12	16.8	115.3	1000	35	3.0	TS
	27/18	16.6	114.7	994	40	3.5	TS
	28/00	16.3	114.2	985	50	4.0	STS
	28/06	16.7	114.0	975	60	5.0	STS
	28/12	16.9	113.9	970	65	5.0	TY
	28/18	16.8	113.4	970	65	5.0	TY
	29/00	16.8	112.5	970	65	5.0	TY
	29/06	16.7	111.8	965	65	5.0	TY
	29/12	16.9	111.1	965	65	5.0	TY
	29/18	16.8	110.1	965	65	5.0	TY
	30/00	17.2	108.7	965	65	5.0	TY
	30/06	17.5	107.5	970	65	5.0	TY
	30/12	17.8	105.9	975	60	4.5	STS
	30/18	17.9	103.8	994	40	4.0	TS
Oct.	01/00	18.0	101.5	1006	-	3.5	TD
	01/06						Dissip.

Sepat (1322)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep.	29/06	26.4	151.5	1002	-	0.5	TD
	29/12	26.3	150.0	1002	-	1.0	TD
	29/18	26.3	148.2	1002	-	1.5	TD
	30/00	26.4	146.8	1000	35	1.5	TS
	30/06	27.0	145.3	998	35	1.5	TS
	30/12	27.8	143.8	996	40	1.5	TS
	30/18	28.5	142.6	994	40	1.5	TS
Oct.	01/00	29.2	142.0	994	40	1.5	TS
	01/06	29.9	141.6	994	40	2.0	TS
	01/12	31.2	141.3	994	40	2.0	TS
	01/18	32.3	141.3	994	40	2.0	TS
	02/00	33.9	141.6	994	40	2.0	TS
	02/06	35.4	141.9	992	40	2.0	TS
	02/12	37.5	143.3	992	40	2.0	TS
	02/18	40.0	146.0	990	-	2.0	L
	03/00	43.8	149.3	990	-	-	L
	03/06	48.4	153.7	996	-	-	L
	03/12	50.8	156.4	1000	-	-	L
	03/18	53.4	161.0	1004	-	-	L
	04/00						Dissip.

Fitow (1323)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep.	29/06	10.3	135.0	1000	-	0.0	TD
	29/12	10.4	134.3	1002	-	1.5	TD
	29/18	10.8	133.8	1000	-	1.5	TD
	30/00	11.8	133.3	1002	-	1.5	TD
	30/06	12.7	133.0	1000	-	1.5	TD
	30/12	13.4	132.6	1000	-	2.0	TD
	30/18	13.8	132.2	996	35	2.0	TS
Oct.	01/00	14.5	131.8	996	35	2.5	TS
	01/06	15.2	131.5	994	35	2.5	TS
	01/12	16.1	131.2	990	45	3.0	TS
	01/18	17.2	131.1	990	45	3.0	TS
	02/00	17.6	130.6	985	50	3.5	STS
	02/06	18.3	130.2	985	50	3.5	STS
	02/12	18.9	129.9	985	50	3.5	STS
	02/18	19.5	129.8	985	50	3.5	STS
	03/00	20.0	129.8	985	50	3.5	STS
	03/06	20.7	129.6	980	55	3.5	STS
	03/12	21.2	129.7	980	55	4.0	STS
	03/18	21.6	129.9	975	60	4.5	STS
	04/00	22.1	129.8	975	60	4.5	STS
	04/06	22.7	129.5	975	60	4.5	STS
	04/12	23.2	129.1	965	70	5.0	TY
	04/18	23.7	128.5	960	75	5.0	TY
	04/21	24.1	128.2	960	75	-	TY
	05/00	24.4	127.6	960	75	5.0	TY
	05/03	24.5	127.3	960	75	-	TY
	05/06	24.7	126.7	960	75	5.0	TY
	05/09	25.1	126.4	960	75	-	TY
	05/12	25.0	125.8	960	75	4.5	TY
	05/15	25.2	125.5	960	75	-	TY
	05/18	25.2	124.9	960	75	4.5	TY
	05/21	25.5	124.4	960	75	4.0	TY
	06/00	25.6	123.7	965	70	4.0	TY
	06/03	25.8	123.3	965	70	-	TY
	06/06	26.0	122.8	965	70	4.0	TY
	06/12	26.7	121.7	975	65	3.5	TY
	06/18	27.0	120.2	975	60	3.5	STS
	07/00	27.0	118.8	996	40	3.0	TS
	07/06	26.9	117.9	1002	-	2.5	TD
	07/12						Dissip.

Danas (1324)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Oct.	01/00	18.1	151.5	1008	-	-	TD
	01/06	17.9	151.6	1008	-	-	TD
	01/12	17.7	151.8	1008	-	-	TD
	01/18	17.4	151.7	1008	-	0.0	TD
	02/00	17.4	151.3	1008	-	0.0	TD
	02/06	17.3	150.6	1006	-	0.5	TD
	02/12	17.0	150.3	1006	-	1.0	TD
	02/18	16.7	150.1	1004	-	1.5	TD
	03/00	16.4	149.9	1004	-	1.5	TD
	03/06	16.0	149.6	1002	-	1.5	TD
	03/12	15.7	148.7	1002	-	1.5	TD
	03/18	15.9	147.7	1002	-	1.5	TD
	04/00	16.4	146.9	1002	-	1.5	TD
	04/06	16.9	146.0	1000	35	2.0	TS
	04/12	17.3	145.0	1000	35	2.5	TS
	04/18	17.9	144.0	996	40	3.0	TS
	05/00	18.2	142.3	994	40	3.5	TS
	05/06	18.8	141.1	992	45	3.5	TS
	05/12	19.3	139.7	985	55	4.5	STS
	05/18	20.3	138.1	975	60	5.0	STS
	06/00	21.2	136.5	970	65	5.0	TY
	06/06	22.0	135.0	965	70	5.0	TY
	06/12	22.7	133.5	955	75	5.5	TY
	06/18	23.9	131.8	945	80	6.0	TY
	06/21	24.5	131.0	940	85	-	TY
	07/00	25.2	130.2	935	90	6.5	TY
	07/03	25.9	129.2	935	90	-	TY
	07/06	26.7	128.7	935	90	6.5	TY
	07/09	27.4	128.0	935	90	-	TY
	07/12	28.1	127.7	935	90	6.5	TY
	07/15	28.9	127.3	935	90	-	TY
	07/18	29.7	127.1	945	80	6.0	TY
	07/21	30.4	127.1	945	80	-	TY
	08/00	31.4	127.0	960	70	5.5	TY
	08/03	32.2	127.3	965	65	-	TY
	08/06	32.8	127.6	970	65	5.0	TY
	08/09	33.8	128.6	975	60	-	STS
	08/12	34.5	129.5	980	55	4.5	STS
	08/15	34.9	130.4	985	50	-	STS
	08/18	35.6	131.6	985	45	4.0	TS
	08/21	36.5	132.9	990	45	-	TS
	09/00	38.0	135.0	992	-	3.5	L
	09/06	37.9	135.8	1002	-	-	L
	09/12						Dissip.

Nari (1325)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Oct.	08/12	14.0	131.6	1004	-	0.5	TD
	08/18	14.1	131.1	1004	-	1.0	TD
	09/00	14.1	130.3	1004	-	1.0	TD
	09/06	14.2	129.5	1000	-	1.0	TD
	09/12	14.5	128.9	998	35	1.0	TS
	09/18	14.8	128.3	994	40	1.5	TS
	10/00	15.1	127.8	992	45	2.0	TS
	10/06	15.3	126.9	990	50	2.5	STS
	10/12	15.3	126.1	980	60	2.5	STS
	10/18	15.3	125.4	975	65	3.0	TY
	11/00	15.3	124.5	970	70	3.5	TY
	11/06	15.3	123.3	970	70	3.5	TY
	11/12	15.4	122.4	970	70	3.5	TY
	11/18	15.5	120.5	975	65	3.5	TY
	12/00	15.2	119.0	975	65	3.0	TY
	12/06	15.2	118.2	970	70	3.5	TY
	12/12	15.0	117.0	970	70	3.5	TY
	12/18	15.1	115.7	965	75	4.0	TY
	13/00	15.3	114.7	965	75	4.0	TY
	13/06	15.3	113.6	965	75	4.0	TY
	13/12	15.2	112.8	965	75	4.0	TY
	13/18	15.3	112.1	965	75	4.0	TY
	14/00	15.5	111.3	965	75	4.0	TY
	14/06	15.9	110.7	965	75	4.0	TY
	14/12	16.3	110.0	970	70	4.0	TY
	14/18	16.0	109.2	975	65	4.0	TY
	15/00	15.5	108.4	985	50	4.0	STS
	15/06	15.5	107.5	994	40	3.5	TS
	15/12	15.4	106.4	998	35	3.0	TS
	15/18	15.4	105.1	1000	-	2.5	TD
	16/00	15.5	104.1	1004	-	2.0	TD
	16/06	15.8	103.3	1004	-	-	TD
	16/12	16.5	102.4	1006	-	-	TD
	16/18						Dissip.

Wipha (1326)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Oct.	09/00	14.0	149.0	1004	-	0.5	TD
	09/06	13.8	148.1	1002	-	0.5	TD
	09/12	13.5	147.0	1004	-	0.5	TD
	09/18	13.5	146.2	1002	-	1.0	TD
	10/00	13.5	145.6	1002	-	1.5	TD
	10/06	13.9	144.7	1000	-	1.5	TD
	10/12	13.8	143.7	998	35	2.0	TS
	10/18	13.5	142.8	996	35	2.0	TS
	11/00	13.7	142.1	994	40	2.5	TS
	11/06	14.2	140.7	992	45	2.5	TS
	11/12	14.7	140.5	990	50	3.0	STS
	11/18	15.4	139.8	985	55	3.5	STS
	12/00	16.1	139.2	980	60	3.5	STS
	12/06	16.7	138.8	980	60	3.5	STS
	12/12	17.3	138.4	970	65	4.0	TY
	12/18	17.9	137.9	960	70	4.5	TY
	13/00	18.4	137.4	955	75	5.0	TY
	13/06	19.1	137.1	950	80	5.0	TY
	13/12	19.8	136.4	930	90	6.0	TY
	13/18	20.5	136.0	930	90	6.0	TY
	14/00	21.8	135.5	935	85	6.0	TY
	14/06	23.0	134.9	940	80	6.0	TY
	14/12	24.2	134.3	940	80	5.0	TY
	14/18	25.4	133.9	945	75	5.0	TY
	15/00	26.7	133.9	945	75	4.5	TY
	15/06	28.5	134.7	945	75	4.0	TY
	15/09	29.4	135.4	945	75	-	TY
	15/12	30.4	136.5	950	70	4.0	TY
	15/15	31.6	137.4	950	70	-	TY
	15/18	32.8	138.6	950	70	4.0	TY
	15/21	34.4	140.3	955	70	-	TY
	16/00	36.2	141.8	960	70	3.5	TY
	16/03	38.4	143.6	965	60	-	STS
	16/06	41.0	146.0	968	-	3.0	L
	16/12	43.6	148.6	964	-	-	L
	16/18	47.7	154.5	958	-	-	L
	17/00	50.1	157.6	960	-	-	L
	17/06	51.7	161.9	964	-	-	L
	17/12	52.6	164.4	964	-	-	L
	17/18	53.3	169.2	964	-	-	L
	18/00	53.5	173.2	964	-	-	L
	18/06	54.4	178.6	964	-	-	L
	18/12	54.7	182.5	968	-	-	Out

Francisco (1327)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Oct.	15/12	13.8	148.9	1008	-	1.0	TD
	15/18	13.4	147.0	1004	-	1.5	TD
	16/00	12.7	145.5	1004	-	2.5	TD
	16/06	12.1	144.4	1000	35	2.5	TS
	16/12	11.3	143.5	996	40	3.0	TS
	16/18	10.8	143.0	990	50	3.5	STS
	17/00	11.0	142.8	985	55	4.0	STS
	17/06	11.4	142.8	975	65	4.5	TY
	17/12	12.0	142.9	970	70	5.0	TY
	17/18	13.0	142.6	965	75	5.0	TY
	18/00	13.8	142.2	950	85	6.0	TY
	18/06	14.2	142.0	935	95	6.5	TY
	18/12	15.2	141.9	930	100	6.5	TY
	18/18	15.9	141.1	920	105	7.0	TY
	19/00	16.2	140.4	920	105	7.0	TY
	19/06	16.7	139.7	920	105	7.0	TY
	19/12	17.1	139.1	920	105	7.0	TY
	19/18	17.4	138.3	920	105	7.0	TY
	20/00	17.8	137.7	920	105	7.0	TY
	20/06	18.3	137.3	925	100	6.5	TY
	20/12	18.7	136.9	925	100	6.0	TY
	20/18	19.3	136.7	935	95	6.0	TY
	21/00	19.7	136.2	940	90	6.0	TY
	21/06	20.3	135.9	940	90	5.5	TY
	21/12	21.0	135.6	940	90	5.5	TY
	21/18	21.6	135.2	940	90	5.5	TY
	22/00	22.3	134.5	945	85	5.5	TY
	22/06	22.8	133.7	945	85	5.5	TY
	22/12	23.2	133.0	945	85	5.5	TY
	22/18	23.5	132.2	945	85	5.5	TY
	23/00	23.9	131.2	950	80	5.0	TY
	23/06	24.3	130.5	955	75	5.0	TY
	23/09	24.4	130.4	955	75	-	TY
	23/12	24.6	130.1	955	70	4.5	TY
	23/15	24.7	130.1	955	70	-	TY
	23/18	24.9	129.9	960	70	4.0	TY
	23/21	25.0	129.8	960	70	-	TY
	24/00	25.1	129.7	960	65	4.0	TY
	24/03	25.4	129.8	960	65	-	TY
	24/06	25.7	129.9	960	65	4.0	TY
	24/09	25.9	130.1	960	65	-	TY
	24/12	26.1	130.2	960	65	4.0	TY
	24/15	26.5	130.4	960	65	-	TY
	24/18	26.9	130.7	965	60	3.5	STS
	24/21	27.4	131.2	965	60	-	STS
	25/00	27.6	131.7	965	60	3.0	STS
	25/06	28.7	132.9	965	60	3.0	STS
	25/12	29.6	134.7	970	60	3.0	STS
	25/15	30.0	135.9	970	60	-	STS
	25/18	31.1	137.4	970	60	3.0	STS
	25/21	31.4	138.5	975	55	-	STS
	26/00	31.8	139.9	980	50	2.5	STS
	26/03	32.2	141.6	980	50	-	STS
	26/06	33.0	144.2	984	-	2.0	L
	26/12	36.5	149.4	988	-	-	L
	26/18						Dissip.

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Lekima (1328)							
Oct.	19/00	9.3	162.4	1008	-	0.0	TD
	19/06	9.1	162.3	1006	-	0.0	TD
	19/12	8.8	162.0	1006	-	0.5	TD
	19/18	9.1	161.7	1004	-	1.0	TD
	20/00	9.4	161.5	1004	-	1.0	TD
	20/06	10.0	161.2	1004	-	1.0	TD
	20/12	10.4	160.9	1004	-	1.5	TD
	20/18	10.9	161.0	1000	35	2.0	TS
	21/00	11.4	161.0	998	40	2.5	TS
	21/06	12.2	160.7	990	50	3.0	STS
	21/12	13.1	160.1	985	55	3.5	STS
	21/18	13.8	159.1	980	55	4.5	STS
	22/00	15.1	158.2	975	60	5.0	STS
	22/06	16.2	156.8	955	80	5.5	TY
	22/12	17.1	155.4	930	100	6.0	TY
	22/18	18.0	154.0	915	110	7.0	TY
	23/00	18.6	152.2	905	115	7.5	TY
	23/06	19.0	150.9	905	115	7.5	TY
	23/12	19.4	149.8	905	115	7.5	TY
	23/18	19.8	148.7	905	115	7.5	TY
	24/00	20.6	147.6	905	115	7.0	TY
	24/06	21.4	146.5	905	115	7.0	TY
	24/12	22.4	145.6	915	105	7.0	TY
	24/18	23.6	144.7	915	105	6.5	TY
	25/00	25.0	144.3	920	100	6.5	TY
	25/06	26.9	144.4	920	100	6.0	TY
	25/12	29.2	145.0	935	90	6.0	TY
	25/18	31.7	146.7	945	85	5.5	TY
	26/00	34.3	149.3	960	75	4.5	TY
	26/06	36.8	152.4	960	75	4.0	TY
	26/12	39.0	155.0	980	-	3.5	L
	26/18	40.2	158.1	980	-	-	L
	27/00	40.4	161.1	980	-	-	L
	27/06	40.8	164.8	980	-	-	L
	27/12	40.9	169.4	984	-	-	L
	27/18	40.8	172.8	984	-	-	L
	28/00	40.7	175.6	988	-	-	L
	28/06	41.7	176.9	988	-	-	L
	28/12	42.7	179.7	990	-	-	L
	28/18	43.5	181.1	992	-	-	Out

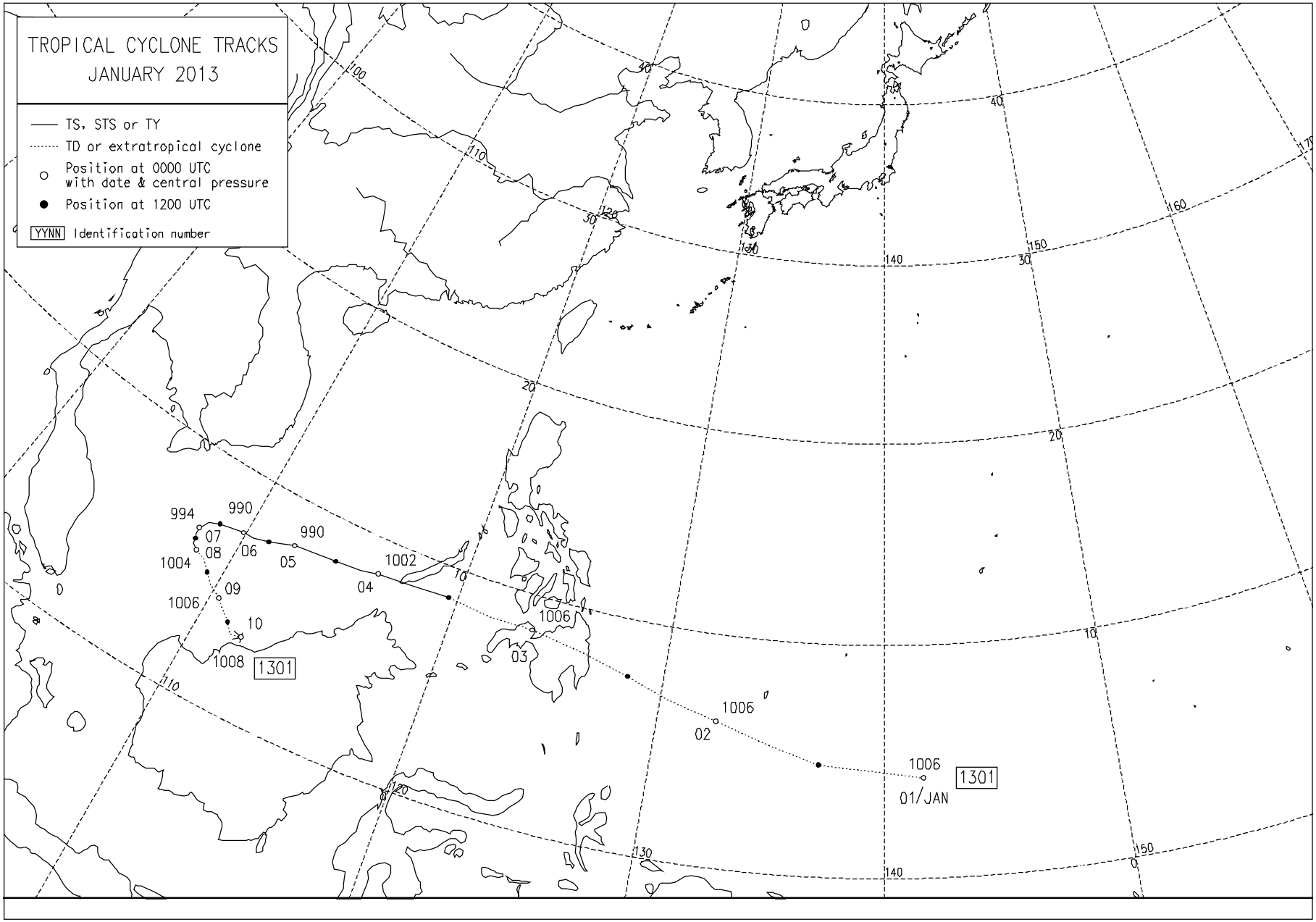
Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Krosa (1329)							
Oct.	27/18	12.9	142.3	1006	-	0.5	TD
	28/00	13.9	140.5	1008	-	0.5	TD
	28/06	14.6	138.8	1006	-	1.0	TD
	28/12	15.4	137.2	1008	-	1.5	TD
	28/18	15.5	135.7	1006	-	2.0	TD
	29/00	15.4	134.5	1004	-	2.0	TD
	29/06	15.5	133.4	1002	-	2.0	TD
	29/12	15.8	132.4	1004	-	2.0	TD
	29/18	16.1	131.1	1000	35	2.5	TS
	30/00	16.4	129.8	996	40	3.0	TS
	30/06	16.9	128.4	994	45	3.0	TS
	30/12	17.2	126.8	992	50	3.5	STS
	30/18	17.5	125.4	990	55	3.5	STS
	31/00	17.6	124.2	985	60	3.5	STS
	31/06	18.0	123.1	980	65	4.0	TY
	31/12	18.3	121.8	975	70	5.0	TY
	31/18	18.5	120.6	975	70	5.0	TY
Nov.	01/00	18.9	119.3	975	70	5.0	TY
	01/06	19.1	118.2	975	70	5.0	TY
	01/12	19.4	117.3	975	70	5.0	TY
	01/18	19.4	116.4	970	75	5.5	TY
	02/00	19.6	115.9	970	75	5.5	TY
	02/06	19.9	115.4	970	75	5.5	TY
	02/12	20.1	115.0	975	70	4.5	TY
	02/18	20.2	114.8	980	65	4.5	TY
	03/00	20.3	114.7	985	60	4.0	STS
	03/06	20.3	114.3	990	55	3.5	STS
	03/12	19.8	113.8	994	45	3.0	TS
	03/18	19.1	113.3	996	40	2.5	TS
	04/00	18.6	112.4	1000	35	2.0	TS
	04/06	17.7	111.2	1004	-	1.5	TD
	04/12	16.8	110.0	1008	-	1.0	TD
	04/18	15.6	109.0	1010	-	-	TD
	05/00						Dissip.

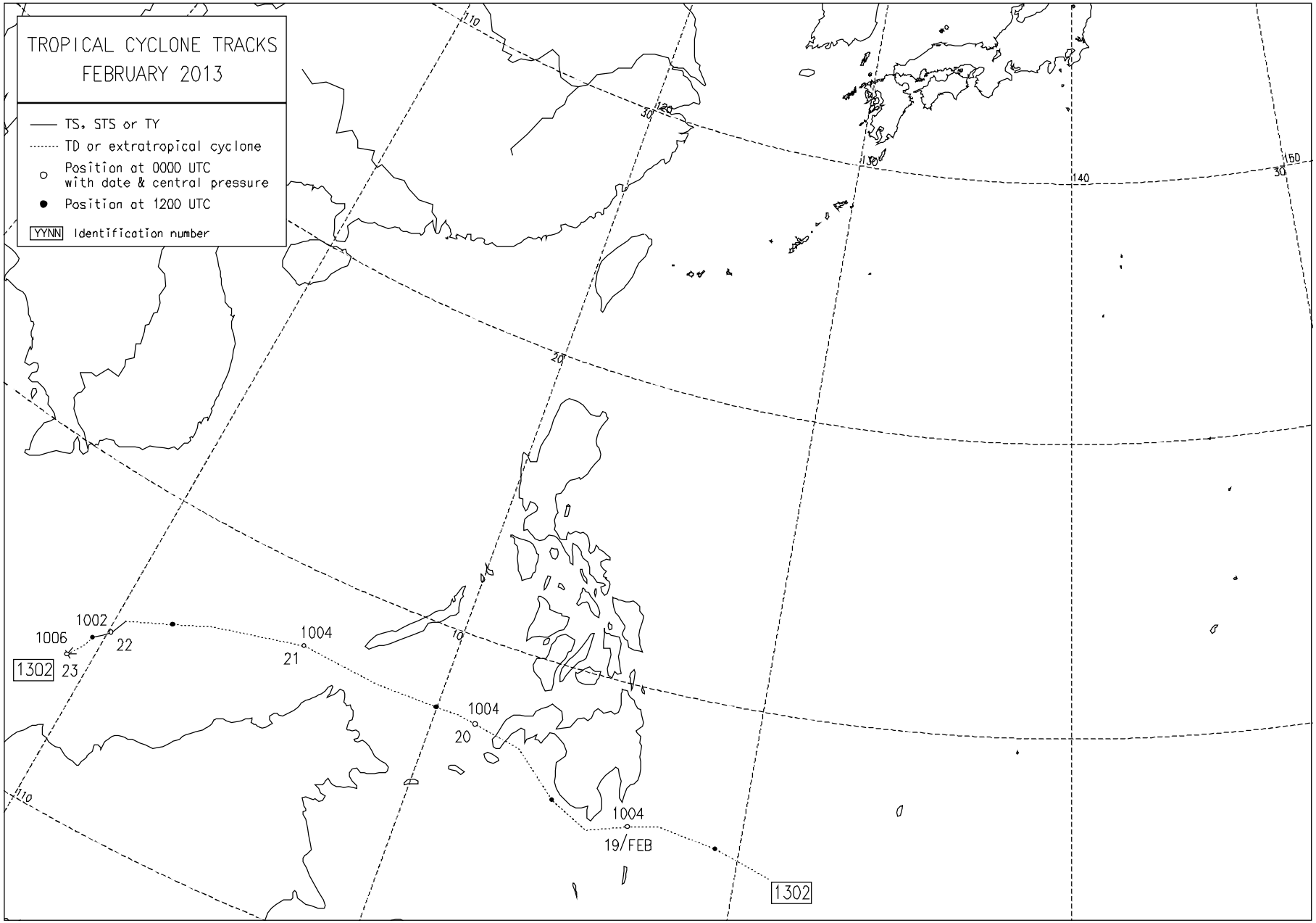
Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Haiyan (1330)							
Nov.	03/06	5.8	157.2	1004	-	0.5	TD
	03/12	6.1	155.5	1008	-	1.0	TD
	03/18	6.1	153.3	1004	-	1.5	TD
	04/00	6.1	152.2	1002	35	2.0	TS
	04/06	6.2	150.4	1000	35	2.0	TS
	04/12	6.3	148.8	998	40	2.5	TS
	04/18	6.5	147.2	992	45	3.0	TS
	05/00	6.5	145.9	985	55	3.5	STS
	05/06	6.5	144.6	980	60	4.0	STS
	05/12	6.9	142.9	975	65	4.5	TY
	05/18	7.1	141.3	965	75	5.0	TY
	06/00	7.3	139.7	950	85	6.0	TY
	06/06	7.6	138.0	930	95	6.5	TY
	06/12	7.9	136.2	920	105	7.0	TY
	06/18	8.2	134.4	905	115	7.5	TY
	07/00	8.7	132.8	905	115	7.5	TY
	07/06	9.3	131.1	905	115	7.5	TY
	07/12	10.2	129.1	895	125	8.0	TY
	07/18	10.6	126.9	895	125	8.0	TY
	08/00	11.0	124.8	910	110	7.0	TY
	08/06	11.4	122.5	940	90	6.5	TY
	08/12	11.9	120.5	940	90	6.0	TY
	08/18	12.2	118.0	940	90	6.0	TY
	09/00	12.3	116.6	940	90	5.0	TY
	09/06	13.5	114.8	940	90	5.0	TY
	09/12	14.4	113.1	945	85	5.0	TY
	09/18	15.4	111.4	950	80	5.0	TY
	10/00	16.5	110.3	955	75	5.0	TY
	10/06	17.9	109.0	960	70	5.0	TY
	10/12	19.4	108.0	965	65	4.5	TY
	10/18	20.4	107.5	975	60	4.0	STS
	11/00	21.5	107.1	990	40	3.5	TS
	11/06	22.4	107.7	1004	-	3.0	TD
	11/12						Dissip.

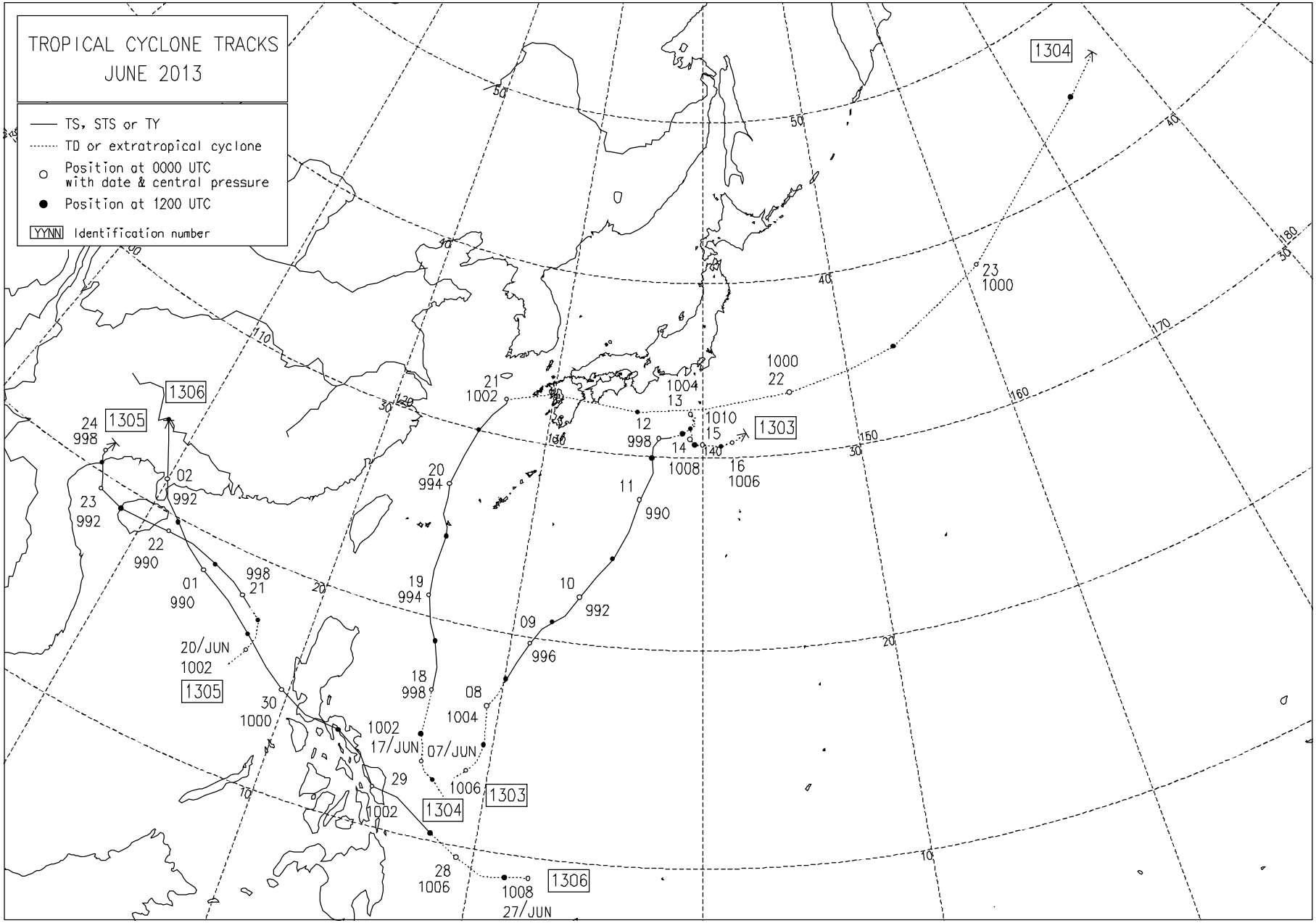
Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Podul (1331)							
Nov.	11/12	5.5	129.9	1000	-	1.5	TD
	11/18	6.5	128.1	1000	-	1.5	TD
	12/00	7.7	126.6	1004	-	1.0	TD
	12/06	8.4	125.5	1002	-	1.0	TD
	12/12	9.3	124.1	1004	-	1.5	TD
	12/18	9.6	121.7	1002	-	1.5	TD
	13/00	10.0	120.0	1006	-	1.5	TD
	13/06	10.4	118.2	1002	-	1.5	TD
	13/12	11.0	117.1	1004	-	1.5	TD
	13/18	11.5	116.2	1004	-	1.5	TD
	14/00	12.2	115.2	1004	-	1.5	TD
	14/06	11.9	112.9	1004	-	1.5	TD
	14/12	11.9	111.7	1002	35	2.0	TS
	14/18	11.8	110.4	1002	35	2.5	TS
	15/00	11.5	108.4	1006	-	2.0	TD
	15/06	11.1	107.1	1006	-	-	TD
	15/12						Dissip.

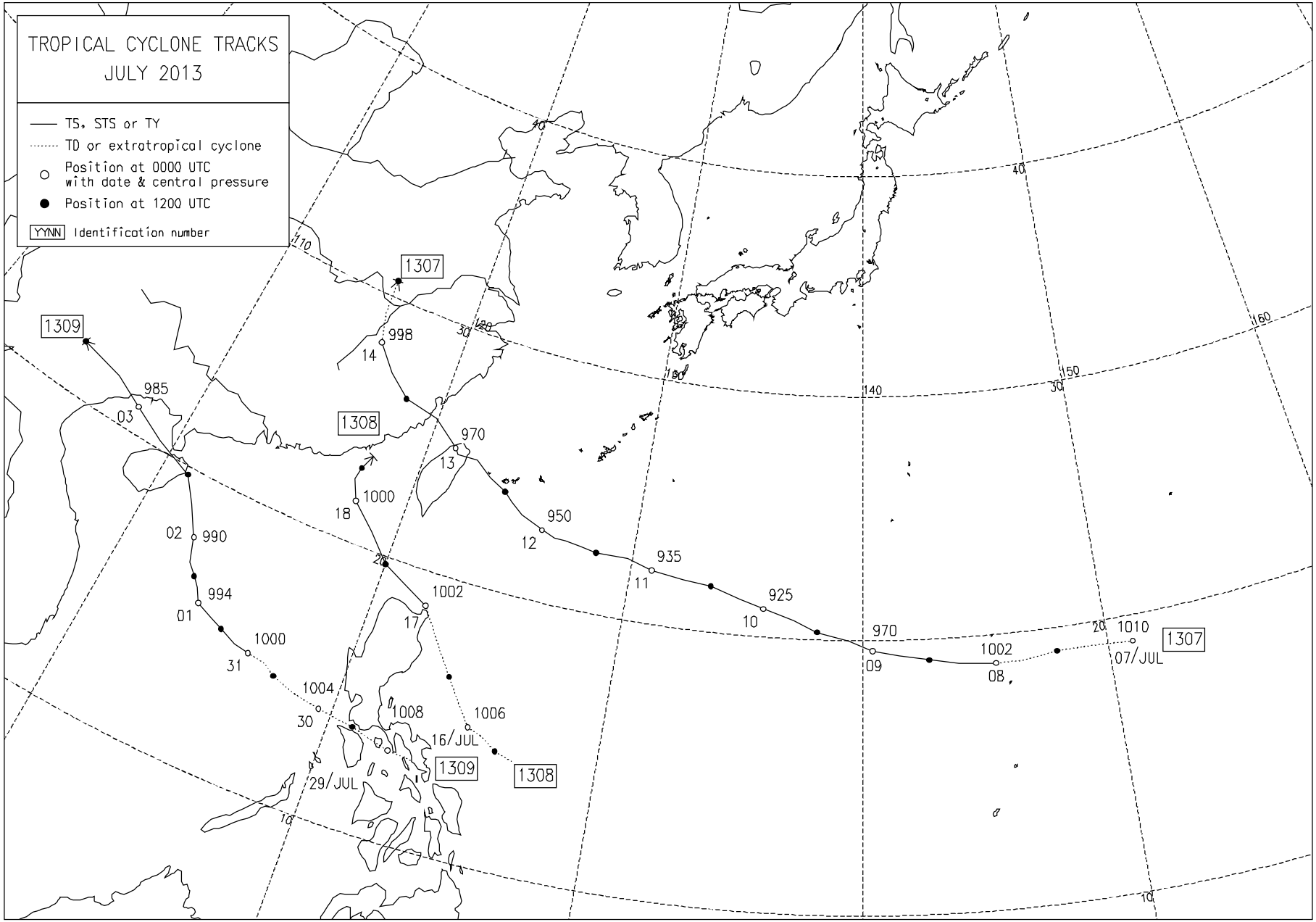
Appendix 2

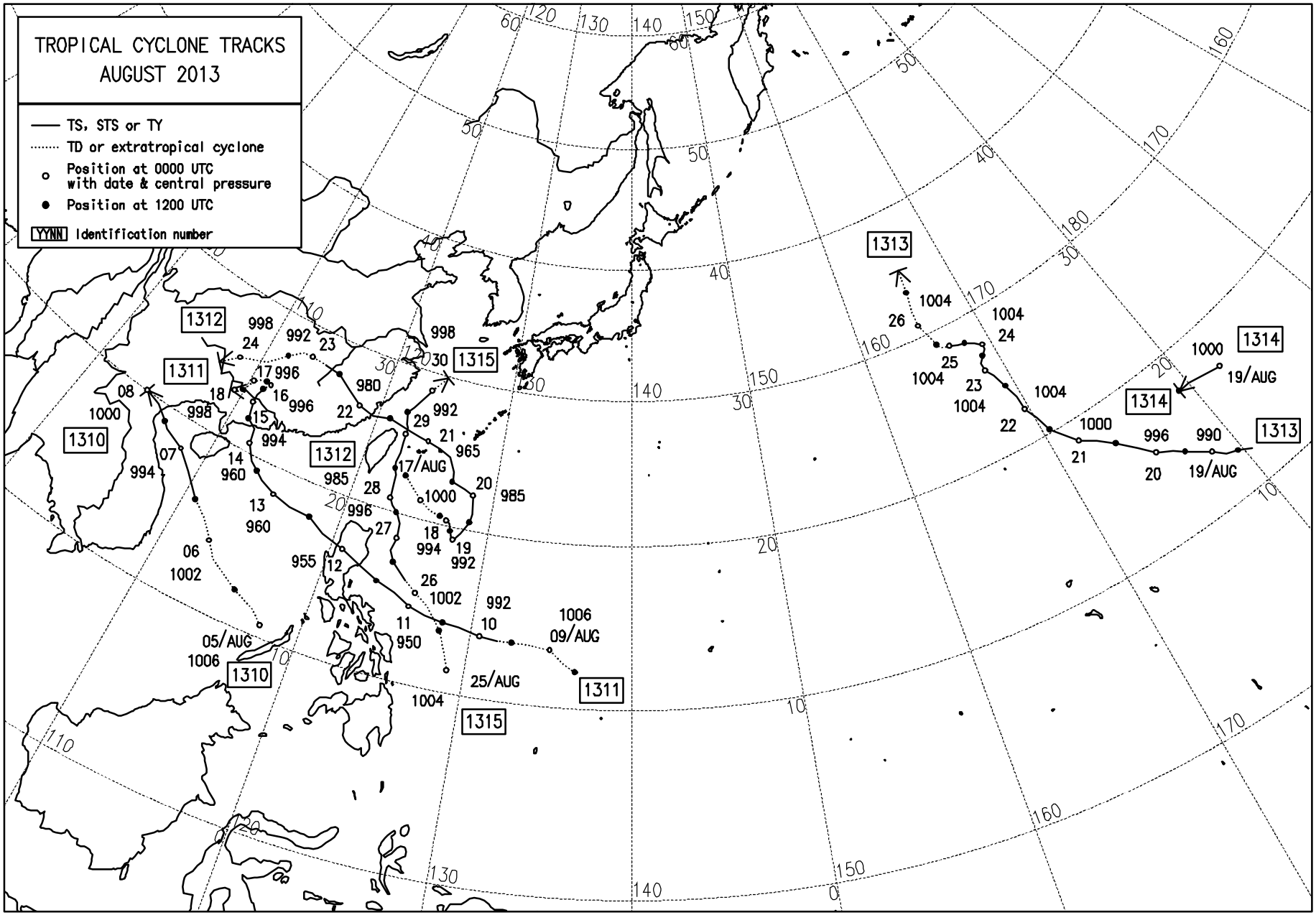
Monthly Tracks of Tropical Cyclones in 2013

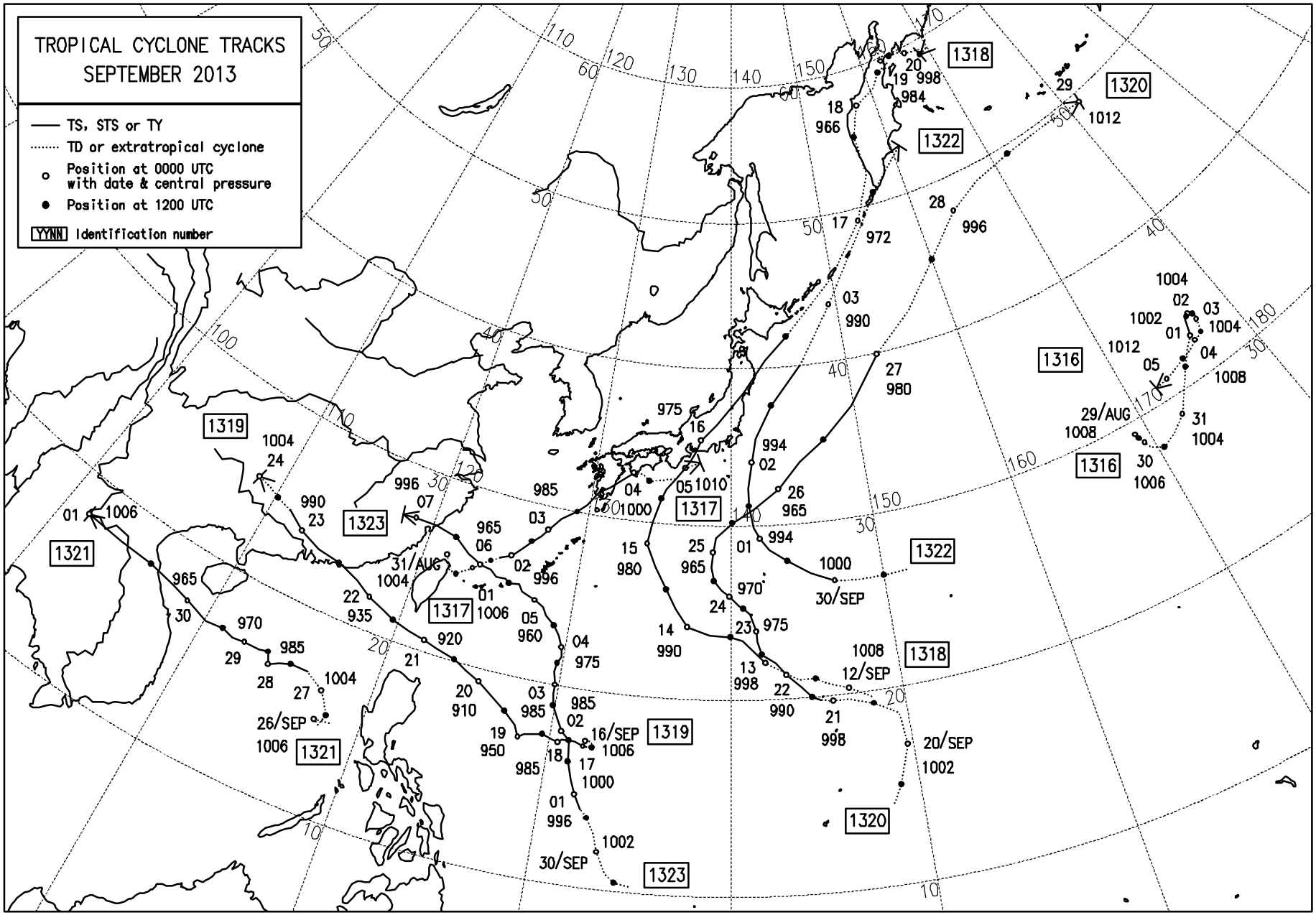

TROPICAL CYCLONE TRACKS
JANUARY 2013
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
994
990
990
1002
1004
1006
1008
1006
1006
1006
07
08
06
05
04
09
10
03
02
01/JAN
1301
1301
100
110
120
130
140
150
160
170
40
30
20
10
0

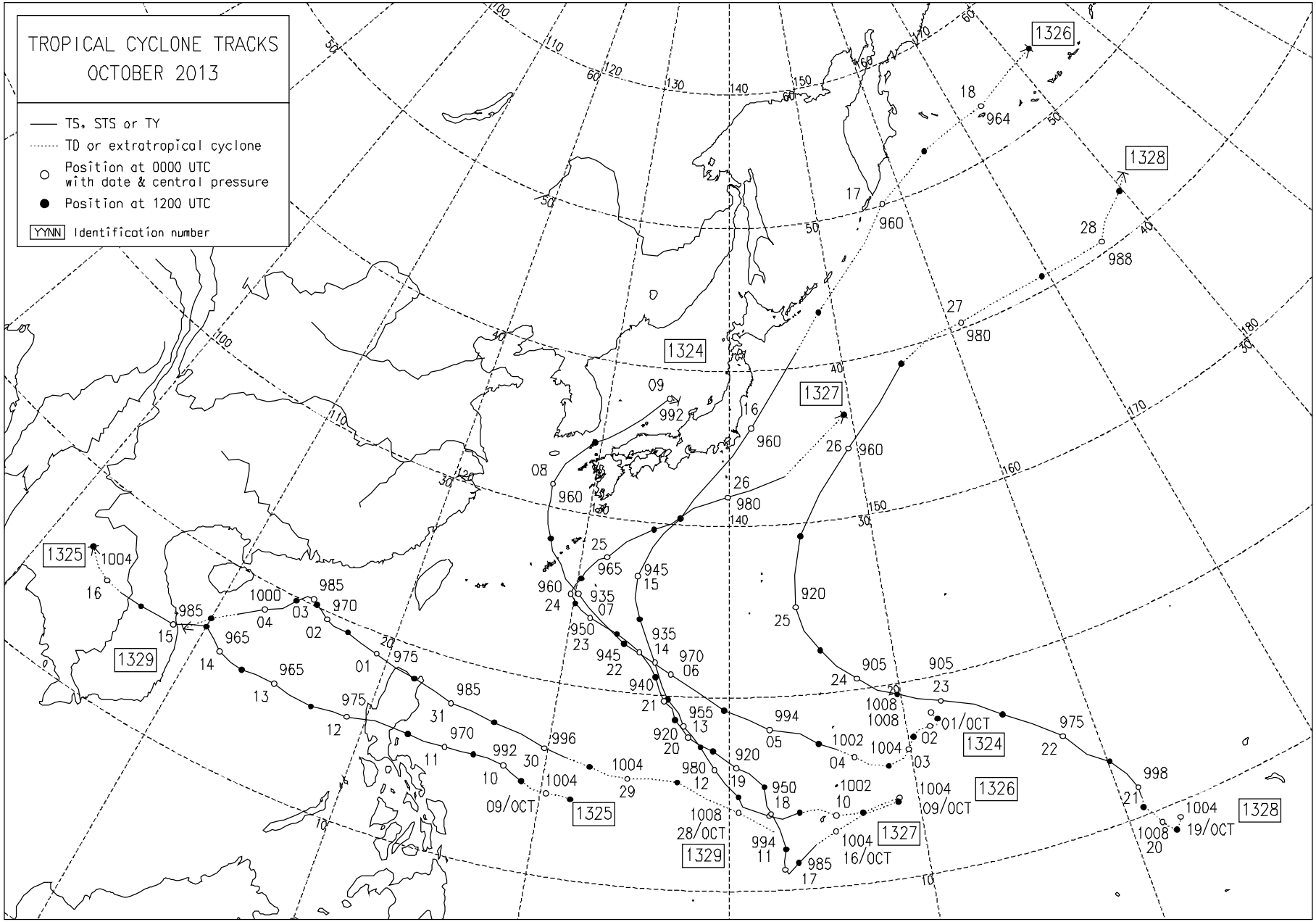

TROPICAL CYCLONE TRACKS
FEBRUARY 2013
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
110
120
130
140
150
30
20
10
1002
1006
22
1004
21
1302
23
1004
20
1004
19/FEB
1302

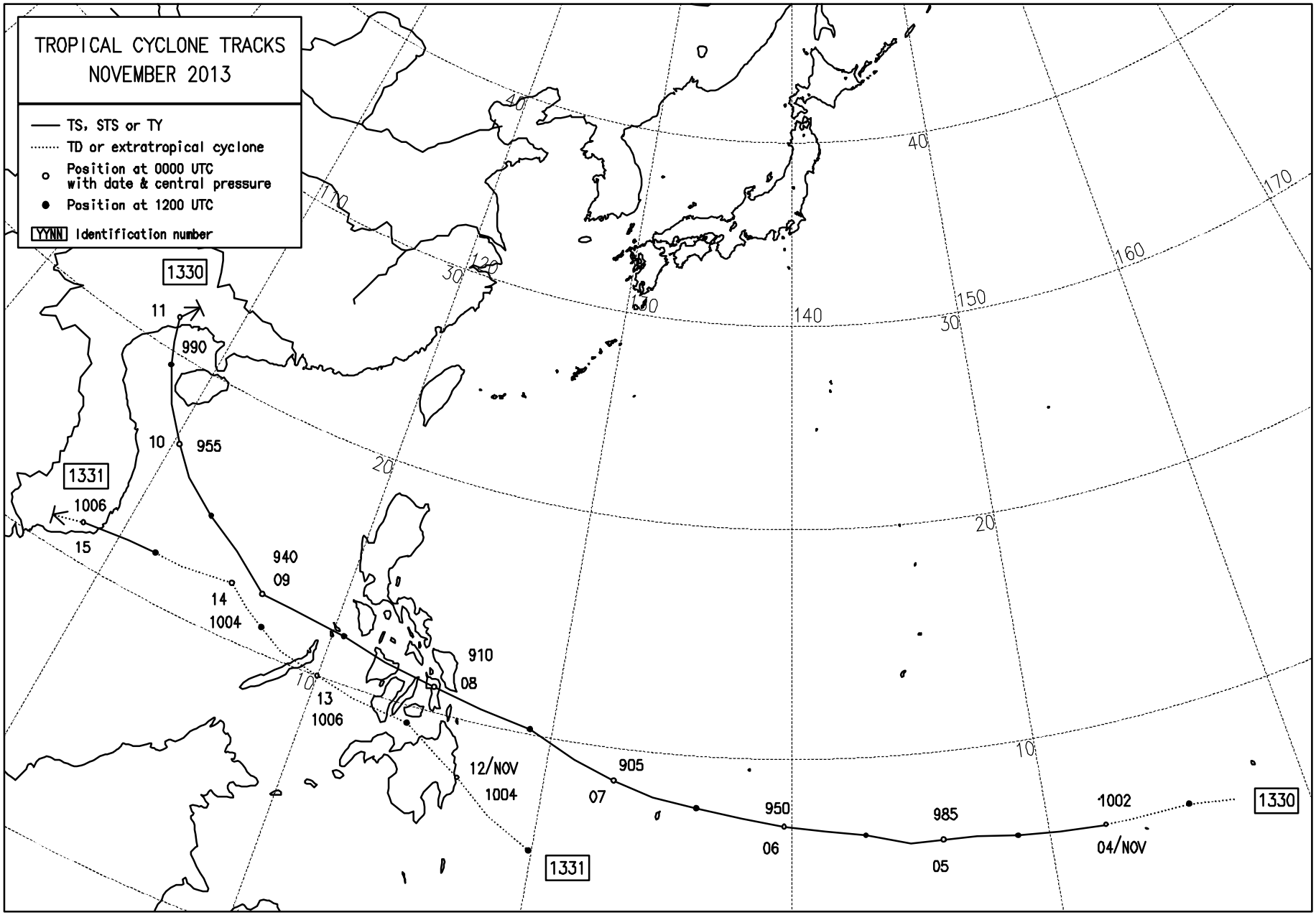

TROPICAL CYCLONE TRACKS
JUNE 2013
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1304
1306
1305
1303
23
1000
1000
22
21
1002
1004
13
1010
15
12
998
14
1008
16
1006
24
998
02
992
23
992
22
990
01
990
998
21
20
994
19
994
11
990
10
992
09
996
08
1004
18
998
1002
17/JUN
07/JUN
1006
29
1002
28
1006
1008
27/JUN
30
1000
20/JUN
1002
1305
1303
1304
1306


TROPICAL CYCLONE TRACKS
JULY 2013
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1307
1309
1308
998
14
985
03
970
13
1000
18
950
12
990
02
935
11
994
01
925
10
1002
17
1000
31
970
09
1010
07/JUL
1002
08
1004
30
1008
1006
16/JUL
29/JUL
110
120
130
140
150
160
40
30
20
10


TROPICAL CYCLONE TRACKS
AUGUST 2013
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1310
1311
1312
1313
1314
1315
05/AUG
09/AUG
17/AUG
19/AUG
25/AUG


TROPICAL CYCLONE TRACKS
SEPTEMBER 2013
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1318
1320
1322
1316
1319
1323
1317
1321
29/AUG
30/SEP
31/AUG
16/SEP
12/SEP
20/SEP
26/SEP


TROPICAL CYCLONE TRACKS
OCTOBER 2013
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1325
1329
1324
1327
1326
1328
09/OCT
28/OCT
01/OCT
16/OCT
19/OCT


TROPICAL CYCLONE TRACKS
NOVEMBER 2013
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1330
11
990
10
955
1331
1006
15
940
09
14
1004
910
08
13
1006
12/NOV
1004
07
905
06
950
05
985
04/NOV
1002
1330
1331
40
170
30
120
100
140
150
160
20
10

Appendix 3

Errors of Track and Intensity Forecasts for Each Tropical Cyclone in 2013

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 Sonamu (1301)													
Jan.	03/12	0	25	47	71	180		-2	0	-4	0	-5	0
	03/18	33	70	102	70	179		2	0	-4	-5	-5	0
	04/00	0	111	124	110			0	0	2	-5	-5	-5
	04/06	22	47	35	70			0	2	4	-5	-5	-5
	04/12	60	109	71	160			2	6	6	-5	-10	-35
	04/18	49	86	40	148			2	6	4	-5	-10	-35
	05/00	60	64	80				4	6		-10	-10	
	05/06	31	35	118				0	4		-5	-5	
	05/12	66	11	158				2	6		-5	-35	
	05/18	33	11	189				2	4		-5	-35	
	06/00	33	33					2			-5		
	06/06	55	71					2			-5		
	06/12	71	118					0			0		
	06/18	33	144					-2			0		
	07/00	40											
	07/06	31											
	07/12	33											
	07/18	50											
	mean	39	67	96	105	180	--	1	3	1	-4	-12	-13
	sample	18	14	10	6	2	0	14	10	6	14	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
TS Shanshan (1302)													
Feb.	21/18	56											
	22/00	81											
	22/06	65											
	mean	67	--	--	--	--	--	--	--	--	--	--	--
	sample	3	0	0	0	0	0	0	0	0	0	0	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 Yagi (1303)													
Jun.	08/12	154	198	399	548			0	2	-4	5	0	5
	08/18	100	144	441	535			0	-5	-11	5	5	15
	09/00	46	105	453	389			-2	-5	-13	5	5	15
	09/06	22	165	488				-2	-5		5	5	
	09/12	0	176	387				-5	-9		0	10	
	09/18	0	210	363				-5	-16		5	20	
	10/00	0	245	313				-5	-13		5	15	
	10/06	0	258					-5			5		
	10/12	0	223					-9			10		
	10/18	0	169					-11			15		
	11/00	0	58					-6			10		
	11/06	0											
	11/12	0											
	11/18	29											
	12/00	0											
	mean	23	177	406	491	--	--	-5	-7	-9	6	9	12
	sample	15	11	7	3	0	0	11	7	3	11	7	3

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 Leepi (1304)													
Jun.	18/00	0	91	49				0	-4		0	5	
	18/06	0	84	29				0	-4		0	5	
	18/12	32	30	139				-2	-6		5	10	
	18/18	0	42	255				-4	-6		5	10	
	19/00	94	122					-4			5		
	19/06	61	132					-4			5		
	19/12	22	125					-4			5		
	19/18	0	119					-4			5		
	20/00	0											
	20/06	0											
	20/12	0											
	20/18	0											
	mean	17	93	118	--	--	--	-3	-5	--	4	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
TS Bebinca (1305)													
Jun.	20/18	64	293					2			0		
	21/00	0	232	502	352			6	4	2	-5	0	-35
	21/06	21	176	252				6	2		-5	0	
	21/12	44	285	175				6	2		-5	0	
	21/18	39	146	146				6	2		-5	0	
	22/00	35	133	103				4	0		0	0	
	22/06	0	100					0			0		
	22/12	0	76					0			0		
	22/18	15	74					0			0		
	23/00	57	35					4			-35		
	23/06	0											
	23/12	24											
	23/18	21											
	24/00	22											
	mean	24	155	236	352	--	--	3	2	2	-5	0	-35
	sample	14	10	5	1	0	0	10	5	1	10	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 Rumbia (1306)													
Jun.	28/12	0	185	285	356			-6	2	5	5	0	-5
	28/18	158	250	320	406			-4	4	0	5	-5	0
	29/00	101	269	446	415			-2	4	-2	0	-5	0
	29/06	60	204	456	511			4	9	-6	-5	-10	10
	29/12	32	144	325				2	9		-5	-10	
	29/18	43	135	208				4	0		-5	0	
	30/00	0	134	153				4	-2		-5	0	
	30/06	0	158	292				5	-6		-5	10	
	30/12	0	97					5			-5		
	30/18	24	71					0			0		
Jul.	01/00	15	90					2			-5		
	01/06	0	67					-2			5		
	01/12	35											
	01/18	10											
	02/00	0											
	02/06	0											
	mean	30	150	311	422	--	--	1	3	-1	-2	-2	1
	sample	16	12	8	4	0	0	12	8	4	12	8	4

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 Soulik (1307)													
Jul.	08/00	46	31	109	98	126	226	26	60	45	-20	-50	-35
	08/06	22	25	69	61	70	250	30	45	20	-25	-30	-15
	08/12	0	22	70	69	171	252	20	25	0	-15	-20	-5
	08/18	0	53	53	67	113	303	20	15	-5	-15	-15	-5
	09/00	0	33	61	108	157		25	5	-20	-20	-5	10
	09/06	22	49	61	60	52		20	-5	-20	-20	-5	10
	09/12	0	39	44	78	253		0	-20	-30	-5	5	15
	09/18	0	33	46	46	240		-15	-25	-30	10	15	20
	10/00	0	33	53	102			-20	-35	-30	15	25	30
	10/06	0	49	47	45			-25	-30	-40	15	20	35
	10/12	0	15	30	96			-25	-25	-40	15	10	30
	10/18	0	22	30	163			-25	-20	-29	15	10	30
	11/00	0	24	46				-25	-15		15	15	
	11/06	0	23	0				-15	-10		10	5	
	11/12	0	62	122				-15	-10		10	0	
	11/18	0	23	126				-10	2		5	-40	
	12/00	0	56					-5			10		
	12/06	0	37					-10			10		
	12/12	0	133					-10			5		
	12/18	0	166					8			-40		
	13/00	0											
	13/06	30											
	13/12	75											
	13/18	78											
	mean	11	46	60	83	148	258	-3	-3	-15	-1	-4	10
	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
TS Cimaron (1308)													
Jul.	17/00	119	228					-2			0		
	17/06	0	182					-2			0		
	17/12	52	33					-4			5		
	17/18	39											
	18/00	43											
	18/06	10											
	18/12	31											
	mean	42	148	--	--	--	--	-3	--	--	2	--	--
	sample	7	3	0	0	0	0	3	0	0	3	0	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 Jebi (1309)													
Jul.	31/00	22	49	95	215			0	2	5	5	5	-5
	31/06	43	39	100	135			0	7	0	5	-5	5
	31/12	21	68	163				0	5		0	-5	
	31/18	0	90	84				0	5		5	-5	
Aug.	01/00	0	86	108				-5	5		10	-5	
	01/06	0	85	130				0	0		-5	0	
	01/12	39	70					0			-5		
	01/18	31	85					0			-5		
	02/00	46	84					0			-5		
	02/06	0	115					0			5		
	02/12	0											
	02/18	0											
	03/00	11											
	03/06	103											
	mean	23	77	114	175	--	--	0	4	3	1	-2	0
	sample	14	10	6	2	0	0	10	6	2	10	6	2

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 Mangkhut (1310)													
Aug.	06/12	0	124					0			0		
	06/18	15	133					2			0		
	07/00	0											
	07/06	0											
	07/12	39											
	07/18	0											
	mean	9	129	--	--	--	--	1	--	--	0	--	--
	sample	6	2	0	0	0	0	2	0	0	2	0	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 Utor (1311)													
Aug.	09/18	22	248	365	672	645	395	43	61	27	-45	-55	-25
	10/00	0	155	370	555	528	420	15	-5	-20	-15	5	15
	10/06	0	102	361	467	403	275	5	-25	-30	-10	15	20
	10/12	0	130	245	317	229		10	-30	-30	-15	20	20
	10/18	0	139	245	227	113		0	-20	-25	-5	15	20
	11/00	0	140	288	170	167		-15	-15	-20	10	15	15
	11/06	0	173	223	99	102		-15	-15	-20	10	15	20
	11/12	0	182	133	98			-25	-25	-40	20	20	30
	11/18	0	39	25	157			-25	-25	-50	15	20	45
	12/00	31	15	90	177			-25	-25	-44	20	20	35
	12/06	0	25	161	203			-15	-30	-19	15	25	30
	12/12	0	11	67				-15	-35		15	25	
	12/18	0	25	83				-15	-20		15	25	
	13/00	0	61	103				-15	-14		15	20	
	13/06	22	89	156				-20	-9		20	15	
	13/12	0	39					-25			20		
	13/18	0	79					-15			15		
	14/00	0	93					-14			5		
	14/06	0	88					-4			0		
	14/12	0											
	14/18	0											
	15/00	0											
	15/06	0											
	mean	3	97	194	286	312	363	-9	-15	-25	6	13	20
	sample	23	19	15	11	7	3	19	15	11	19	15	11

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 Trami (1312)													
Aug.	18/00	38	203	79	161	146		0	5	20	0	-5	-10
	18/06	53	172	33	159	250		-2	5	15	5	-5	-5
	18/12	98	157	176	75	142		0	5	15	0	-5	-5
	18/18	146	156	126	37			0	10	15	0	-5	-5
	19/00	105	61	45	70			-5	10	-5	5	0	10
	19/06	0	93	69	105			0	10	5	0	0	5
	19/12	69	41	175	179			0	10	4	0	0	5
	19/18	128	148	245				10	15		-5	-5	
	20/00	113	157	300				15	5		-5	0	
	20/06	0	75	118				15	9		-5	-5	
	20/12	0	93	100				10	4		0	0	
	20/18	33	80					10			0		
	21/00	10	87					5			0		
	21/06	0	35					7			0		
	21/12	0	69					8			-35		
	21/18	0											
	22/00	0											
	22/06	37											
	22/12	0											
	mean	44	108	133	112	179	--	5	8	10	-3	-3	-1
	sample	19	15	11	7	3	0	15	11	7	15	11	7

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 Pewa (1313)													
Aug.	18/12	49	209	289	384	693	963	-5	-23	-29	0	20	25
	18/18	0	126	257	435	666	1110	-11	-23	-29	10	20	25
	19/00	0	56	89	188	466	789	-16	-25	-29	20	35	35
	19/06	31	64	78	165	347	642	-18	-25	-29	25	35	35
	19/12	40	119	57	199	395	556	-18	-29	-29	25	35	35
	19/18	0	139	43	193	384	345	-18	-29	-29	25	35	35
	20/00	0	114	68	152	354		-10	-14	-12	20	20	15
	20/06	0	62	92	246	419		-8	-12	-8	15	15	10
	20/12	40	57	152	338	363		-12	-12	-8	10	10	5
	20/18	33	68	232	465	383		-12	-12	-8	10	10	5
	21/00	0	83	212	519			-12	-12	-8	10	10	5
	21/06	21	121	236	499			-12	-12	-8	10	10	5
	21/12	76	23	160	266			-4	-4	-2	5	5	0
	21/18	33	90	316	249			-4	-4	-2	5	5	0
	22/00	30	90	336				-4	-4		5	5	
	22/06	22	119	308				-4	-4		5	5	
	22/12	30	139	171				-4	-4		5	5	
	22/18	83	247	160				-4	-4		5	5	
	23/00	33	247					-4			5		
	23/06	20	226					-4			5		
	23/12	20	22					-4			5		
	23/18	69	39					-4			5		
	24/00	39											
	24/06	29											
	24/12	59											
	24/18	20											
	mean	30	112	181	307	447	734	-9	-14	-16	10	16	17
	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
Unala (1314)													
	mean	--	--	--	--	--	--	--	--	--	--	--	--
	sample	0	0	0	0	0	0	0	0	0	0	0	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 Kong-rey (1315)													
Aug.	26/06	0	49	115	304			-2	5	-6	0	-5	10
	26/12	0	33	108	261			0	5	-21	0	-5	25
	26/18	0	80	98	83			-5	-5	-31	5	5	35
	27/00	24	53	170				0	-22		0	25	
	27/06	0	85	153				0	-21		5	30	
	27/12	0	105	213				-5	-16		10	20	
	27/18	0	84	172				-5	-16		10	20	
	28/00	24	55					-17			25		
	28/06	22	37					-21			30		
	28/12	23	15					-21			30		
	28/18	0	59					-21			25		
	29/00	0											
	29/06	22											
	29/12	0											
	29/18	33											
	mean	10	60	147	216	--	--	-9	-10	-19	13	13	23
	sample	15	11	7	3	0	0	11	7	3	11	7	3

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 Yutu (1316)													
Sep.	01/00	0											
	01/06	0											
	01/12	9											
	mean	3	--	--	--	--	--	--	--	--	--	--	--
	sample	3	0	0	0	0	0	0	0	0	0	0	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 Toraji (1317)													
Sep.	01/18	0	31	393				4	5		-5	-5	
	02/00	0	82					9			-10		
	02/06	0	168					9			-10		
	02/12	0	141					5			-5		
	02/18	0	274					5			-5		
	03/00	20											
	03/06	22											
	03/12	29											
	03/18	11											
	mean	9	139	393	--	--	--	6	5	--	-7	-5	--
	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 Man-yi (1318)													
Sep.	13/00	226	244	273	266			0	0	5	0	5	-5
	13/06	94	78	118	281			5	0	-5	-5	5	5
	13/12	67	83	102				0	15		0	-10	
	13/18	38	30	113				-5	15		5	-10	
	14/00	15	15	112				0	0		5	-5	
	14/06	22	87	61				-5	0		10	0	
	14/12	32	22					10			-5		
	14/18	15	9					10			-5		
	15/00	0	100					0			-5		
	15/06	19	335					-5			5		
	15/12	0											
	15/18	15											
	16/00	0											
	16/06	0											
	mean	39	100	130	274	--	--	1	5	0	1	-2	0
	sample	14	10	6	2	0	0	10	6	2	10	6	2

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 Usagi (1319)													
Sep.	16/18	194	230	297	379	262	155	0	20	55	0	-15	-40
	17/00	182	268	373	409	241	68	5	30	55	-5	-25	-40
	17/06	78	273	333	325	137	73	5	50	55	-5	-35	-40
	17/12	63	165	302	265	208	167	15	55	50	-15	-40	-35
	17/18	35	115	185	160	237	279	20	60	45	-15	-45	-30
	18/00	25	113	74	102	209	368	25	55	35	-20	-40	-25
	18/06	22	115	73	57	152		40	45	25	-25	-35	-10
	18/12	0	75	31	96	220		45	40	20	-30	-30	-5
	18/18	25	44	66	106	321		35	25	15	-30	-20	-5
	19/00	0	33	94	145	363		35	15	5	-30	-10	0
	19/06	0	71	135	201			5	-15	-10	-10	15	10
	19/12	0	43	137	173			0	-15	-5	-5	15	10
	19/18	0	62	84	200			-5	-10	-25	5	10	30
	20/00	0	44	49	93			-10	-5	-20	10	5	20
	20/06	0	70	21				-10	5		15	0	
	20/12	0	46	61				-5	5		15	5	
	20/18	0	41	38				-5	-20		10	25	
	21/00	15	46	69				5	-25		0	25	
	21/06	0	91					5			-5		
	21/12	0	78					10			-5		
	21/18	0	65					-20			25		
	22/00	0	56					-15			20		
	22/06	0											
	22/12	0											
	22/18	0											
	23/00	22											
	mean	25	98	135	194	235	185	8	18	21	-5	-11	-11
	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 Pabuk (1320)													
Sep.	21/06	22	91	42	155	91	224	0	5	0	-5	5	10
	21/12	0	84	45	100	177	433	-5	-5	-5	10	15	15
	21/18	0	24	102	137	338	726	0	-5	-5	10	15	15
	22/00	0	78	113	134	463		0	-5	-5	10	15	15
	22/06	0	132	89	178	647		5	-5	-5	5	15	15
	22/12	0	69	15	80	341		5	0	-5	5	10	15
	22/18	0	92	97	279	782		0	0	-5	10	10	15
	23/00	0	69	150	398			-5	0	-5	5	5	10
	23/06	0	59	46	226			-5	0	-10	5	0	5
	23/12	0	78	46	222			0	0	-5	0	0	0
	23/18	0	30	73	265			0	0	-5	0	0	-5
	24/00	0	41	75				0	0		0	0	
	24/06	0	98	133				0	-5		0	0	
	24/12	0	11	113				0	-5		0	0	
	24/18	0	19	100				0	-5		0	-5	
	25/00	0	58					0			0		
	25/06	0	46					-5			0		
	25/12	0	86					5			-5		
	25/18	0	82					0			-5		
	26/00	0											
	26/06	0											
	26/12	0											
	26/18	0											
	mean	1	66	83	198	406	461	0	-2	-5	2	6	10
	sample	23	19	15	11	7	3	19	15	11	19	15	11

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 Wutip (1321)													
Sep.	27/06	0	149	288	632			21	27	20	-20	-20	-20
	27/12	22	21	109	425			22	20	10	-20	-15	-10
	27/18	48	65	101	465			15	15	-14	-15	-10	15
	28/00	31	98	77				15	15		-10	-10	
	28/06	0	48	202				5	5		0	-5	
	28/12	0	44	254				-5	-15		10	15	
	28/18	15	96	361				-5	-34		10	35	
	29/00	0	85					-5			10		
	29/06	11	42					-10			10		
	29/12	0	78					0			0		
	29/18	0	163					-4			5		
	30/00	0											
	30/06	0											
	30/12	0											
	30/18	21											
	mean	10	81	199	507	--	--	4	5	5	-2	-1	-5
	sample	15	11	7	3	0	0	11	7	3	11	7	3

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 Sepat (1322)													
Sep.	30/00	20	35	89				4	4		-5	-5	
	30/06	24	36	88				4	6		-5	-5	
	30/12	0	87	124				2	6		5	0	
	30/18	41	56					0			5		
Oct.	01/00	40	38					2			0		
	01/06	31	76					4			0		
	01/12	44	63					4			0		
	01/18	36											
	02/00	24											
	02/06	0											
	02/12	0											
	mean	24	56	100	--	--	--	3	5	--	0	-3	--
	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 Fitow (1323)													
Sep.	30/18	0	46	117	94	143	416	0	-5	-10	0	5	10
Oct.	01/00	40	49	100	89	182	468	0	-10	-15	5	10	15
	01/06	22	42	80	69	261	578	0	-5	-15	5	5	15
	01/12	0	98	56	112	281	587	-5	-15	-10	5	15	5
	01/18	0	158	145	180	377	675	-10	-10	-5	10	10	0
	02/00	0	119	112	149	459	804	-15	-15	-5	15	15	0
	02/06	0	59	64	158	429		-10	-15	-5	10	15	0
	02/12	0	15	24	101	311		-10	-10	-10	10	5	5
	02/18	0	21	23	127	357		-5	-5	-10	5	0	5
	03/00	0	33	93	143	481		-5	-5	-15	5	0	10
	03/06	0	53	35	132			-5	-5	-15	5	0	10
	03/12	0	53	64	170			5	-5	-25	-5	0	15
	03/18	0	30	120	229			5	-5	-20	-5	0	15
	04/00	0	33	87	190			-5	-10	-11	0	5	10
	04/06	0	35	41				-10	-10		5	5	
	04/12	20	42	90				-10	-20		5	10	
	04/18	0	55	129				-10	-5		5	5	
	05/00	0	60	152				-10	-21		5	20	
	05/06	20	46					-10			5		
	05/12	30	96					-5			-5		
	05/18	15	68					5			-5		
	06/00	10	140					-6			5		
	06/06	0											
	06/12	0											
	06/18	41											
	07/00	54											
	mean	10	61	85	139	328	588	-5	-10	-12	4	7	8
	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
TY Danas (1324)													
Oct.	04/06	64	128	278	506	736		4	25	50	-5	-25	-40
	04/12	0	43	84	323	757		11	35	50	-15	-30	-40
	04/18	0	31	84	256	781		17	45	40	-15	-35	-30
	05/00	0	30	49	156			20	50	25	-20	-40	-20
	05/06	0	46	113	139			20	45	10	-20	-35	-10
	05/12	0	53	166	331			20	40	-5	-10	-25	10
	05/18	0	33	113	176			20	15	-10	-10	-5	15
	06/00	0	23	80				25	15		-15	-10	
	06/06	0	52	56				20	5		-10	-5	
	06/12	0	81	172				20	0		-10	0	
	06/18	0	84	185				5	-5		5	10	
	07/00	0	123					-20			25		
	07/06	0	102					-30			30		
	07/12	0	191					-25			25		
	07/18	0	190					-10			15		
	08/00	0											
	08/06	44											
	08/12	0											
	08/18	18											
	mean	7	81	125	270	758	--	6	25	23	-2	-18	-16
	sample	19	15	11	7	3	0	15	11	7	15	11	7

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 Nari (1325)													
Oct.	09/12	39	78	112	282	391	376	12	15	15	-15	-20	-20
	09/18	31	39	250	276	289	266	15	10	20	-20	-15	-25
	10/00	31	35	236	188	180	223	5	-5	5	-10	0	-10
	10/06	0	77	113	108	60	223	0	5	5	-5	-10	-10
	10/12	0	74	147	108	68	250	-10	-5	-5	5	0	0
	10/18	0	143	228	123	200		-15	10	0	10	-15	-5
	11/00	0	188	160	133	256		-5	5	0	0	-10	-5
	11/06	21	64	64	96	252		0	-5	-10	-5	0	0
	11/12	32	49	97	153	385		0	-5	-15	-5	0	5
	11/18	22	35	93	159			5	-5	-20	-5	0	10
	12/00	22	32	62	171			0	-10	-30	-5	0	25
	12/06	22	34	86	217			0	-10	-39	-5	0	35
	12/12	33	78	140	339			0	-15	-38	-5	5	40
	12/18	22	77	180				0	-20		0	15	
	13/00	0	78	204				-10	-25		5	25	
	13/06	0	97	294				-10	-39		5	40	
	13/12	31	96	291				-15	-43		10	45	
	13/18	15	111					-20			15		
	14/00	0	113					-20			25		
	14/06	22	95					2			-5		
	14/12	0	84					4			-35		
	14/18	0											
	15/00	43											
	15/06	0											
	15/12	79											
	mean	19	80	162	181	231	268	-3	-8	-9	-2	4	3
	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 Wipha (1326)													
Oct.	10/12	55	78	67				8	20		-15	-20	
	10/18	0	76	99	178	480	1115	0	10	35	-5	-5	-20
	11/00	24	68	145	259	485	1183	5	15	25	-10	-10	-10
	11/06	119	105	179	290	620		5	20	15	-10	-15	-5
	11/12	68	84	151	313	541		10	35	15	-10	-20	-5
	11/18	40	25	74	267	530		15	30	5	-10	-15	5
	12/00	0	55	154	246	909		15	20	5	-10	-10	5
	12/06	22	71	121	239			15	15	5	-10	-5	5
	12/12	40	70	122	307			25	10	0	-15	0	10
	12/18	0	94	157	340			20	5	5	-10	5	5
	13/00	0	106	170	554			10	0	-5	-5	5	5
	13/06	0	108	250				0	0		5	5	
	13/12	0	88	183				-10	-5		10	10	
	13/18	0	88	284				-15	-5		15	10	
	14/00	0	46	357				-15	-5		15	5	
	14/06	0	59					-10			10		
	14/12	0	73					-5			10		
	14/18	24	53					5			0		
	15/00	10	93					0			0		
	15/06	10											
	15/12	15											
	15/18	30											
	16/00	11											
	mean	20	76	167	299	594	1149	4	11	11	-2	-4	0
	sample	23	19	15	10	6	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 Francisco (1327)													
Oct.	16/06	67	272					21			-30		
	16/12	49	127	97	134	245	312	20	45	40	-20	-35	-30
	16/18	55	55	21	126	223	290	10	40	30	-10	-30	-25
	17/00	22	49	88	124	203	258	20	35	30	-20	-30	-25
	17/06	22	55	91	94	189	278	15	20	10	-15	-20	-10
	17/12	0	15	81	122	231	363	20	20	5	-15	-15	-5
	17/18	0	22	79	143	235	423	30	15	-5	-20	-10	0
	18/00	0	65	57	100	138	359	20	10	-10	-15	-10	5
	18/06	0	46	31	54	118	417	10	-5	-15	-5	5	10
	18/12	0	61	109	113	225	468	0	-5	-15	0	5	10
	18/18	0	102	134	211	362	534	0	-15	-10	0	10	5
	19/00	0	57	101	145	319	490	-10	-25	-15	10	15	15
	19/06	0	57	112	156	387	576	-15	-25	-15	15	15	15
	19/12	0	59	81	188	431	555	-15	-25	-15	15	15	15
	19/18	0	46	79	197	417	472	-15	-20	-15	10	15	15
	20/00	0	24	66	216	289	404	-20	-20	-20	15	20	20
	20/06	0	21	103	245	257	299	-15	-20	-25	10	15	20
	20/12	0	39	145	246	193	158	-15	-15	-20	10	10	20
	20/18	10	66	156	228	145	210	-5	0	-10	5	5	15
	21/00	10	38	52	50	108	509	-5	-5	-10	5	5	15
	21/06	0	45	61	24	233		-5	-10	-10	5	10	15
	21/12	0	39	42	24	204		0	-5	-10	0	10	15
	21/18	0	22	50	122	286		0	-10	-15	0	10	20
	22/00	0	51	112	153	449		0	-5	-5	0	10	15
	22/06	0	74	109	132			-5	-5	-5	5	10	15
	22/12	0	78	134	130			-5	-5	-5	10	10	10
	22/18	0	61	82	45			-10	-10	-5	10	15	10
	23/00	0	75	92	144			-5	-5	-15	10	15	20
	23/06	0	63	104				0	0		10	10	
	23/12	0	98	80				0	-5		5	5	
	23/18	15	140	58				0	0		5	0	
	24/00	0	67	126				10	0		0	5	
	24/06	15	15					10			0		
	24/12	15	95					5			0		
	24/18	11	145					10			-5		
	25/00	0	94					5			0		
	25/06	41											
	25/12	0											
	25/18	0											
	26/00	0											
	mean	8	68	88	136	256	388	2	-2	-6	0	3	8
	sample	40	36	31	27	23	19	36	31	27	36	31	27

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 Lekima (1328)													
Oct.	20/18	33	168	280	248	346	1022	12	65	65	-10	-55	-50
	21/00	40	193	269	290	405	1016	10	70	60	-10	-55	-45
	21/06	0	135	140	157	257	876	20	55	45	-15	-35	-30
	21/12	0	49	52	56	314		45	55	35	-35	-40	-20
	21/18	0	42	46	61	414		50	50	35	-35	-35	-20
	22/00	0	39	47	101	478		60	50	30	-40	-35	-15
	22/06	0	54	144	211	547		35	30	15	-25	-20	-5
	22/12	0	81	83	111			15	5	-5	-10	0	0
	22/18	0	88	128	44			0	0	-15	0	5	5
	23/00	0	84	98	149			5	15	0	-5	-5	0
	23/06	0	38	45	224			10	20	10	-10	-5	-10
	23/12	0	41	106				5	10		-5	-10	
	23/18	0	117	201				10	5		-10	-5	
	24/00	0	74	220				10	0		-10	0	
	24/06	0	30	272				10	0		-10	0	
	24/12	0	124					5			-5		
	24/18	0	126					5			-5		
	25/00	0	50					0			5		
	25/06	0	77					10			-5		
	25/12	0											
	25/18	0											
	26/00	0											
	26/06	0											
	mean	3	85	142	150	395	971	17	29	25	-13	-20	-17
	sample	23	19	15	11	7	3	19	15	11	19	15	11

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 Krosa (1329)													
Oct.	29/18	49	168	226	331	536	644	6	21	24	-15	-30	-35
	30/00	0	56	140	231	483	575	-5	0	-10	-5	-10	0
	30/06	0	25	68	133	362		-5	-5	-10	-5	-5	0
	30/12	0	35	92	287	442		0	-15	-20	-10	5	5
	30/18	0	75	128	373	476		0	-10	-25	-10	0	10
	31/00	33	33	133	376	393		0	-10	-30	-10	0	15
	31/06	0	39	204	422			-5	-15	-35	-5	0	20
	31/12	0	59	206	353			-15	-15	-29	5	5	25
	31/18	0	56	209	295			-10	-15	-21	0	10	25
Nov.	01/00	0	76	267	277			-10	-20	-25	0	10	25
	01/06	0	100	275				-10	-25		0	15	
	01/12	21	114	314				-10	-24		5	25	
	01/18	0	146	284				-15	-21		10	25	
	02/00	0	192	245				-20	-20		20	25	
	02/06	21	183					-15			20		
	02/12	0	148					-19			30		
	02/18	11	116					-16			20		
	03/00	10	109					-15			15		
	03/06	0											
	03/12	79											
	03/18	33											
	04/00	0											
	mean	12	96	199	308	449	610	-9	-12	-18	4	5	9
	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
TY Haiyan (1330)													
Nov.	04/00	0	301	473	487	633	813	7	30	60	-10	-30	-45
	04/06	0	175	337	317	523	640	5	45	55	-10	-35	-40
	04/12	22	64	168	157	426	618	10	55	65	-15	-45	-50
	04/18	44	147	292	340	589	638	10	60	60	-15	-45	-50
	05/00	0	126	214	242	412	304	20	50	35	-20	-40	-30
	05/06	0	123	150	253	292	345	35	45	5	-25	-35	-10
	05/12	22	153	139	239	246	423	40	50	10	-30	-40	-10
	05/18	0	111	132	230	116	546	45	45	10	-30	-35	-5
	06/00	0	65	125	117	168	619	25	10	-10	-20	-5	5
	06/06	0	62	210	164	281		20	-20	-10	-15	15	5
	06/12	0	98	207	148	415		5	-15	-15	-5	10	10
	06/18	0	110	207	173	519		0	-10	-25	0	5	20
	07/00	0	131	98	214	594		-10	-10	-15	10	5	15
	07/06	0	142	62	299			-30	0	-10	20	0	10
	07/12	0	109	56	332			-40	-30	-35	30	25	35
	07/18	0	55	95	479			-40	-30	-35	30	25	30
	08/00	0	39	119	442			-35	-35	-40	25	30	45
	08/06	11	31	155				-20	-30		15	25	
	08/12	24	62	237				-25	-25		10	20	
	08/18	31	55	297				-10	-15		5	15	
	09/00	0	101	254				-10	-30		10	35	
	09/06	0	140					-15			15		
	09/12	0	182					-5			10		
	09/18	0	215					-15			15		
	10/00	0	207					-15			20		
	10/06	11											
	10/12	10											
	10/18	11											
	11/00	25											
	mean	7	120	192	273	401	550	-2	7	6	1	-5	-4
	sample	29	25	21	17	13	9	25	21	17	25	21	17

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 Podul (1331)													
Nov.	14/12	76											
	14/18	46											
	mean	61	--	--	--	--	--	--	--	--	--	--	--
	sample	2	0	0	0	0	0	0	0	0	0	0	0

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 - 2013

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
2013	1	1				4	3	6	8	6	2		31
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 Model	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. Figure 6.1)
Forecast time (and initials)	84h (00, 06, 18 UTC) 264h (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 forecast period was extended to 264 hours at 12UTC (March 2013).
- Improvement of radiation processes (April 2013).

Global Data Assimilation System:

- Assimilation of AVHRR-AMV and LEOGEO wind data (July 2013).
- Assimilation of JAXA's GCOM-W1/AMSR2 radiance data (September 2013).

- Assimilation of SYNOP BUFR data (October 2013).
- Assimilation of GRAS, AMSU-A, MHS, ASCAT and AVHRR-AMV data from Metop-B (November 2013).

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.

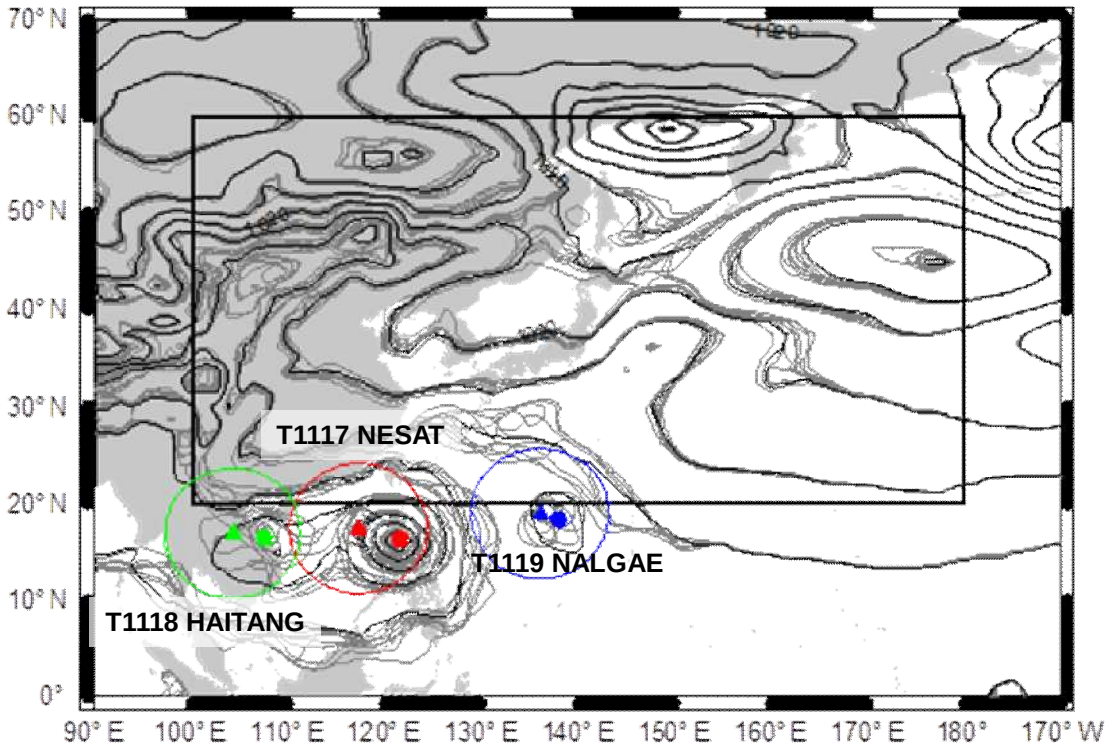


Figure 6.1 Example of SV spatial target areas of TEPS (Initial time: 00UTC 27 September 2011). The large thick rectangle shows the fixed area and the circles show the three movable areas which are set around a predicted TC's position. Filled circles and triangles show TCs' central positions at the initial 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/index.htm

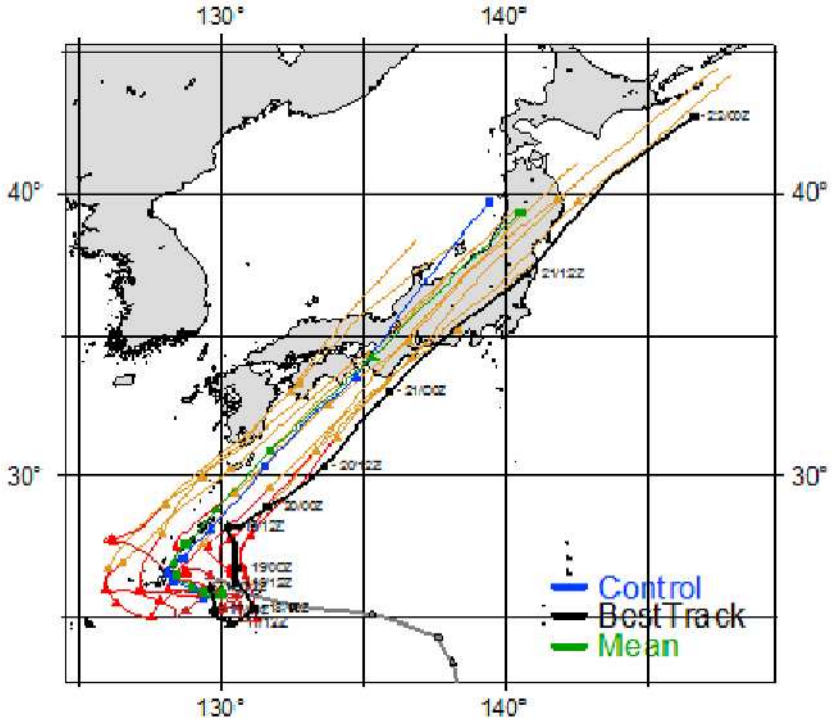


Figure 6.2 Example of TEPS forecast track (Initial time: 12UTC 16 September 2011). Black, blue, and green lines denote TC best track, forecast track of control member and ensemble mean respectively. Red (up to 96-hour) and yellow (up to 120-hour) lines show TC forecast tracks of all perturbed members.

Appendix 7

NWP products (GSM and EPS) provided 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 and 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 and 96–192 every 24 hours for 12UTC ° 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	00, 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 3 hours) 90– 264 (every 6 hours) are available for 12 UTC Initial	0– 84 (every 3 hours) 90– 264 (every 6 hours) are available 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 96-264 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 • storm surge distribution (map image) • time series charts (at requested locations) The plotted values are storm surges, predicted water levels, astronomical tides, surface winds, and sea level pressures. 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/)
SATAID service	(a) Satellite imagery (SATAID) MTSAT (b) Observation data (SATAID) SYNOP, SHIP, METAR, TEMP (A, B) and ASCAT sea-surface wind (c) NWP products (SATAID) GSM (Available at http://www.wis-jma.go.jp/cms/sataid/)

Appendix 8

User's Guide to the DVD

Preface

This DVD contains all the texts, tables and charts of the RSMC Annual Report 2013 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 2013. 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 2013 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
        |---T1301 (hourly satellite image data)
        |---T1302 (hourly satellite image data)
                :
        |---T1331 (hourly satellite image data)
|------Andata
        |--Besttrack
            |--E_BST_2013.txt (best track data for 2013)
            |--E_BST_201301.txt (best track data for TCs generated in January 2013)
                        :
            |--E_BST_201311.txt (best track data for TCs generated in November 2013)
```

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 2013, 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 2013 >

Annual Report 2013 is provided in two formats as PDF files and MS Word/Excel files.

- PDF files:

Click the *Annual Report 2013* 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 2013 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 >

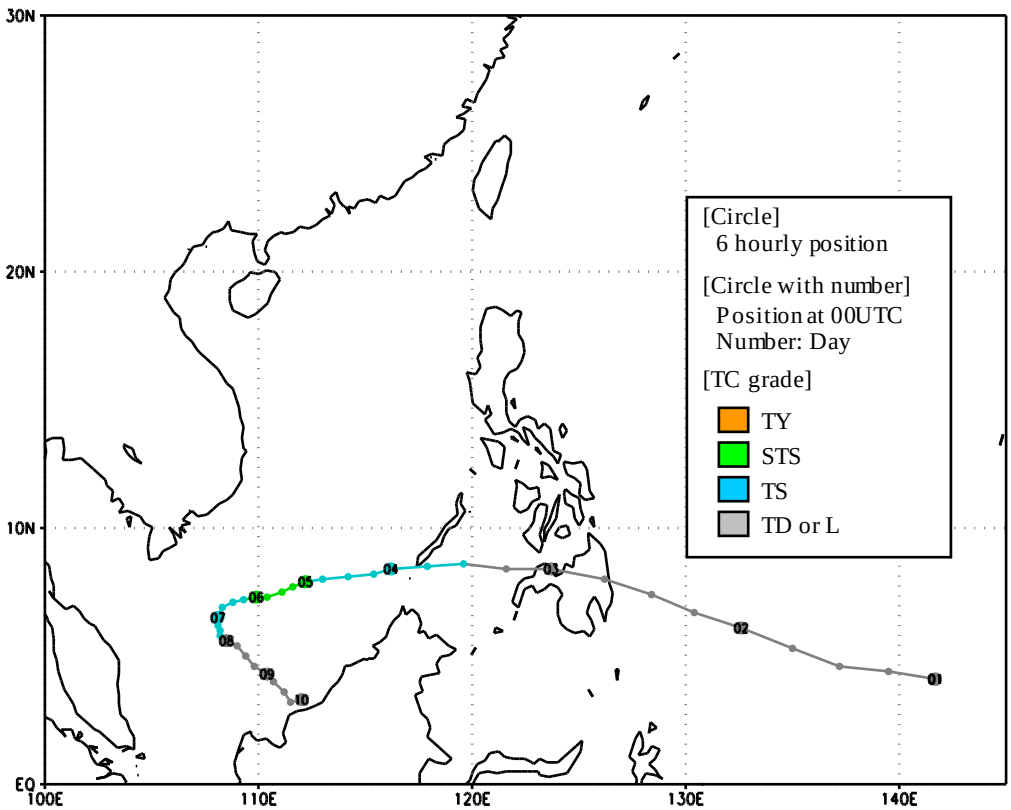
Document files can be opened from the file list box in the start menu window. Choose a file and click the *Open* button, or simply double-click the file name.

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

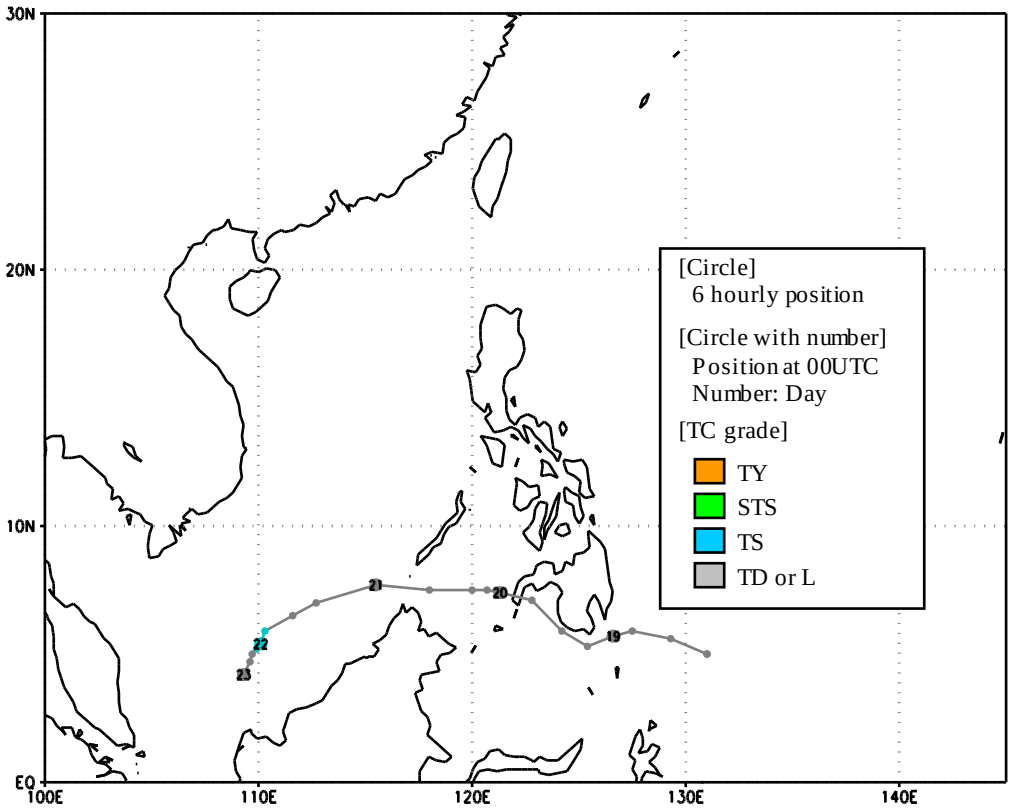
SONAMU (1301)

SONAMU formed as a tropical depression (TD) over the sea near the Caroline Islands at 00 UTC on 1 January 2013. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity over the Sulu Sea at 12 UTC on 3 January after crossing Mindanao Island. Moving west-southwestward, SONAMU 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 near the Spratly Islands at 00 UTC on 5 January. Keeping its west-southwestward track, it was downgraded to TS intensity over the sea south of Viet Nam at 06 UTC the next day. Turning southeastward, SONAMU weakened to TD intensity over the same waters at 00 UTC on 8 January and dissipated off the coast of East Malaysia at 06 UTC on 10 January.



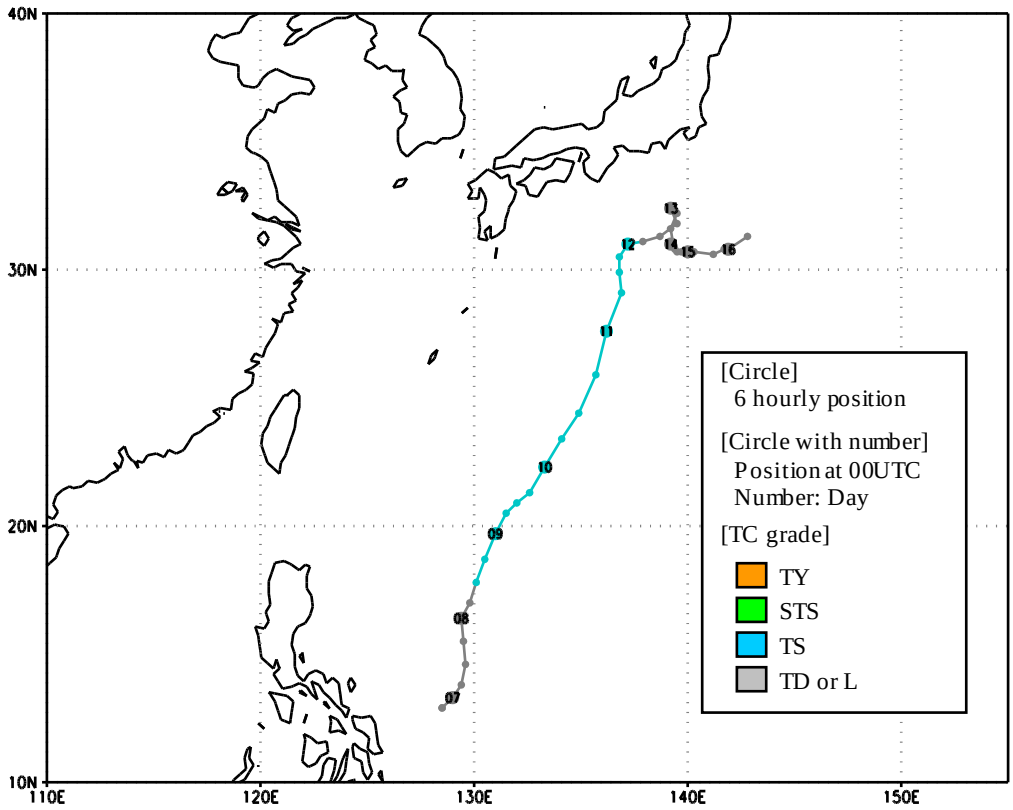
SHANSHAN (1302)

SHANSHAN formed as a tropical depression (TD) over the sea southeast of Mindanao Island at 06 UTC on 18 February 2013 and moved westward. Passing south of Mindanao Island and crossing the Sulu Sea, it entered the South China Sea late on 20 February. Decelerated southwestward, SHANSHAN was upgraded to tropical storm (TS) intensity over the South China Sea at 18 UTC the next day when it reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 1002 hPa. SHANSHAN was downgraded to TD intensity over the same waters at 12 UTC on 22 February and dissipated 18 hours later.



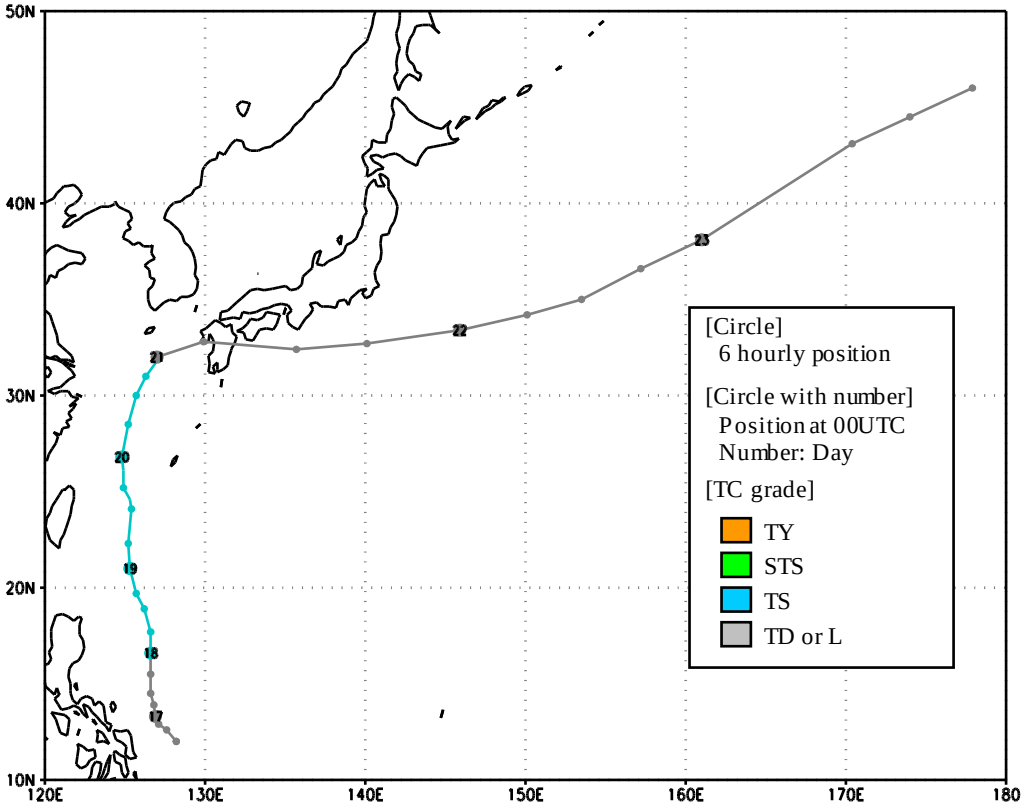
YAGI (1303)

YAGI formed as a tropical depression (TD) east of the Philippines at 18 UTC on 6 June 2013. It moved northeastward and turned northward the next day. After turning north-northeastward on 8 June, YAGI was upgraded to tropical storm (TS) intensity over the same waters at 12 UTC the same day. Moving north-northeastward, it reached its peak intensity with maximum sustained winds of 45 kt and a central pressure of 990 hPa south of Honshu Island at 12 UTC on 10 June. YAGI decelerated northward over the same waters the next day. After turning eastward, YAGI transformed into an extratropical cyclone over the same waters at 06 UTC on 12 June. It slowly moved eastward and dissipated southeast of Hachijojima Island at 12 UTC on 16 June.



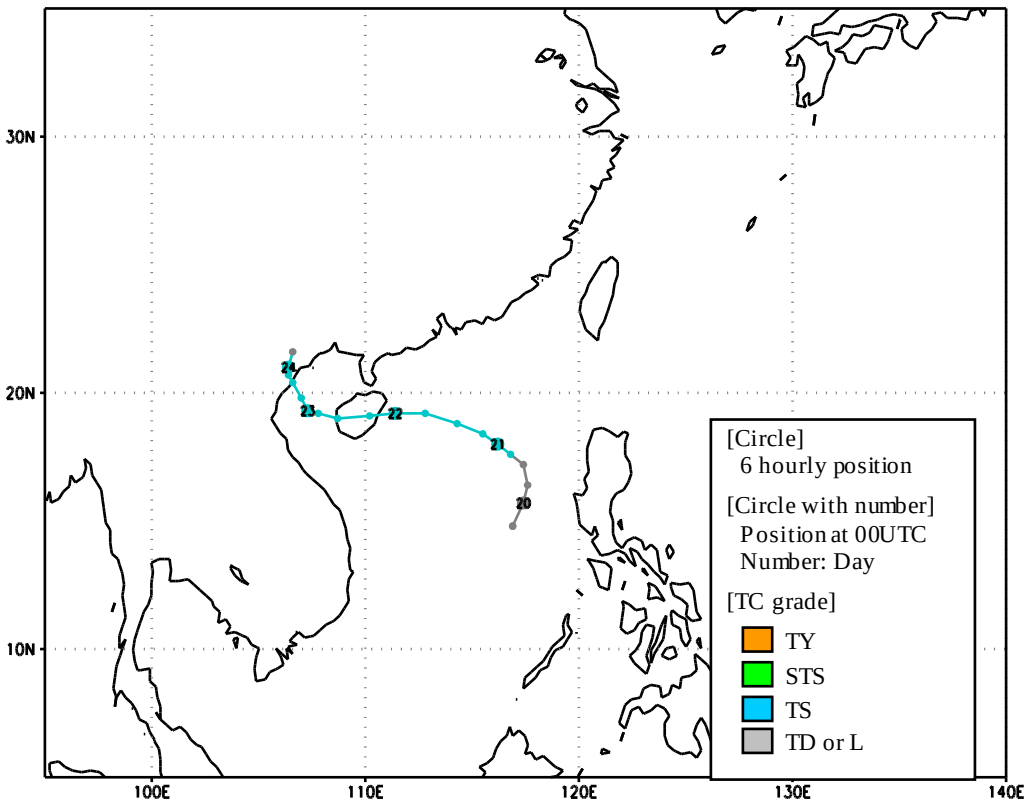
LEEPI (1304)

LEEPI formed as a tropical depression (TD) over the sea east of the Philippines at 06 UTC on 16 June 2013. Moving northward, it was upgraded to tropical storm (TS) intensity over the same waters at 00 UTC on 18 June and reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 994 hPa 18 hours later. LEEPI transformed into an extratropical cyclone over the East China Sea at 00 UTC on 21 June and turned eastward. It gradually turned northeastward on 22 June and dissipated south of the Aleutian Islands at 00 UTC on 24 June.



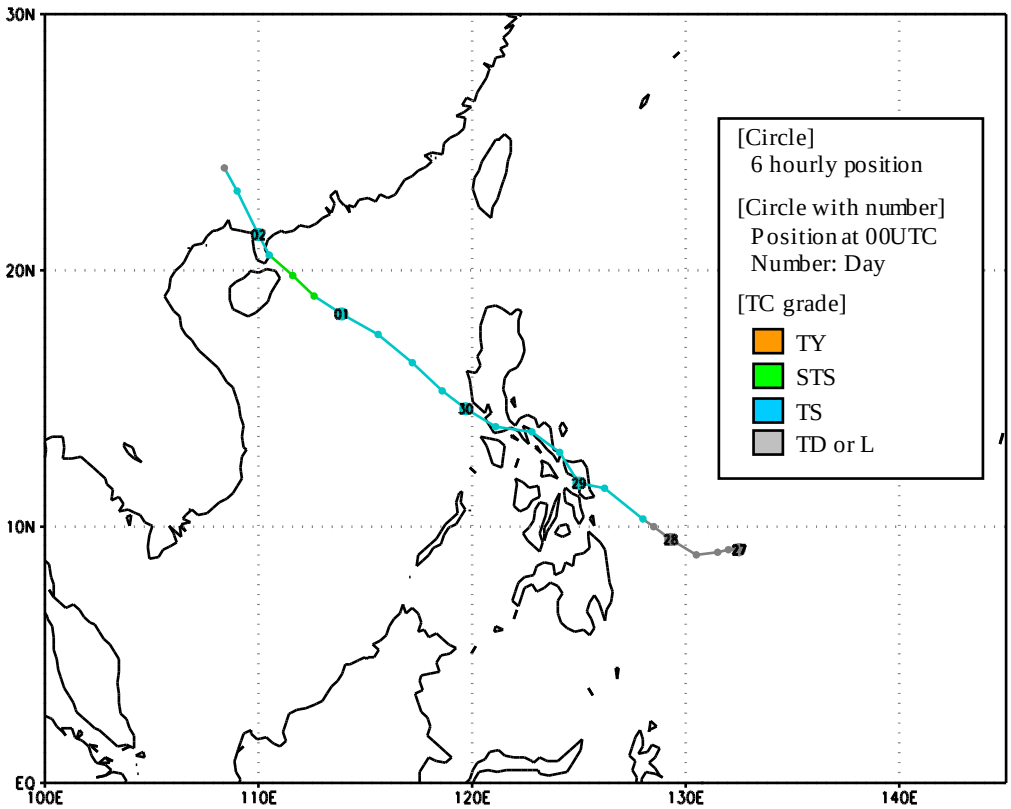
BEBINCA (1305)

BEBINCA formed as a tropical depression (TD) over the sea west of Luzon Island at 18 UTC on 19 June 2013. Moving north-northeastward, it was upgraded to tropical storm (TS) intensity over the same waters at 18 UTC the next day after turning northwestward. Keeping its westward track, BEBINCA reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 990 hPa at 00 UTC on 22 June and then crossed Hainan Island. After turning north-northwestward over the Gulf of Tonkin, it weakened to TD intensity over the northern part of Viet Nam at 06 UTC on 24 June and dissipated six hours later.



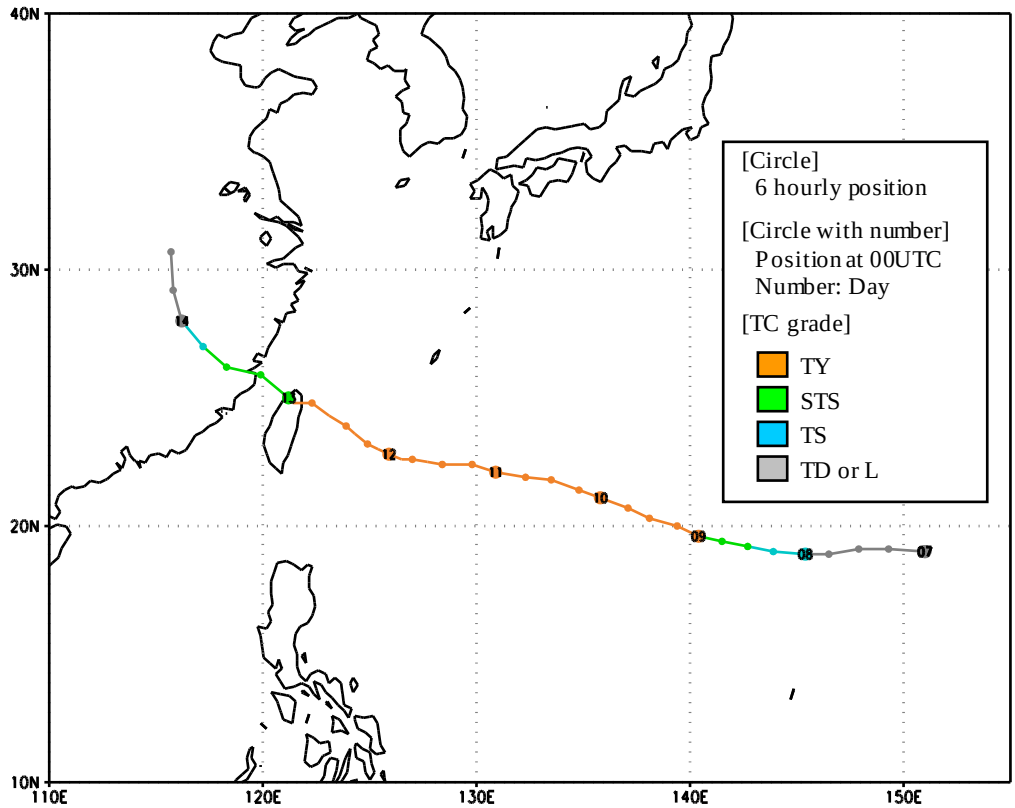
RUMBIA (1306)

RUMBIA formed as a tropical depression (TD) over the sea northwest of the Palau Islands at 00 UTC on 27 June 2013 and moved westward. Turning northwestward, RUMBIA was upgraded to tropical storm (TS) intensity northeast of Mindanao Island at 12 UTC the next day. It passed over the Philippines and entered the South China Sea late on 29 June. Keeping its northwestward track, RUMBIA was upgraded to severe tropical storm (STS) intensity east of Hainan Island at 06 UTC on 1 July and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 985 hPa. It hit the southern part of China before 00 UTC the next day. RUMBIA was weakened to TD intensity over the same region at 12 UTC on 2 July and dissipated six hours later.



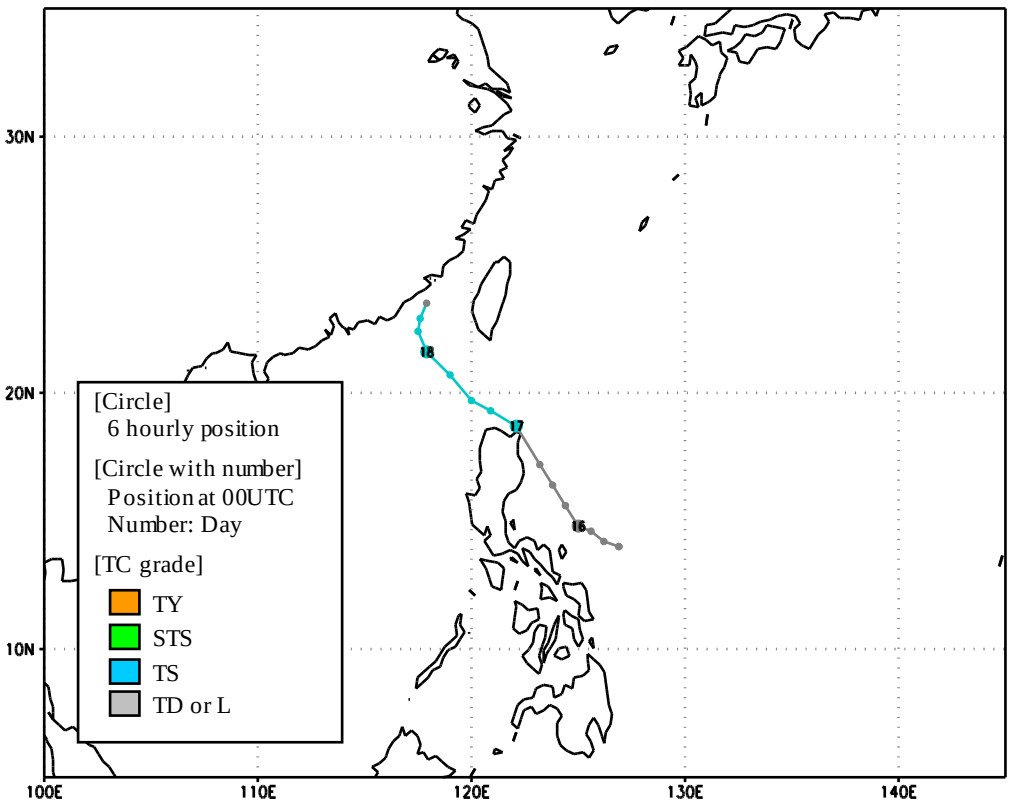
SOULIK (1307)

SOULIK formed as a tropical depression (TD) northeast of the Mariana Islands at 00 UTC on 7 July 2013. Moving westward, it was upgraded to tropical storm (TS) intensity north of the islands at 00 UTC on 8 July and was further upgraded to typhoon (TY) intensity northwest of the islands at 00 UTC the next day. Turning west-northwestward, SOULIK developed rapidly and reached its peak intensity with maximum sustained winds of 100 kt and a central pressure of 925 hPa north of Okinotorishima Island at 00 UTC on 10 July. Keeping its west-northwestward track and TY intensity, it hit the northern part of Taiwan Island late on 12 July. After being downgraded to severe tropical storm (STS) intensity over the island at 00 UTC on 13 July, SOULIK crossed the Taiwan Strait and hit China with STS intensity the same day. Turning northward, it weakened to TD intensity on 00 UTC on 14 July and dissipated at 18 UTC the same day.



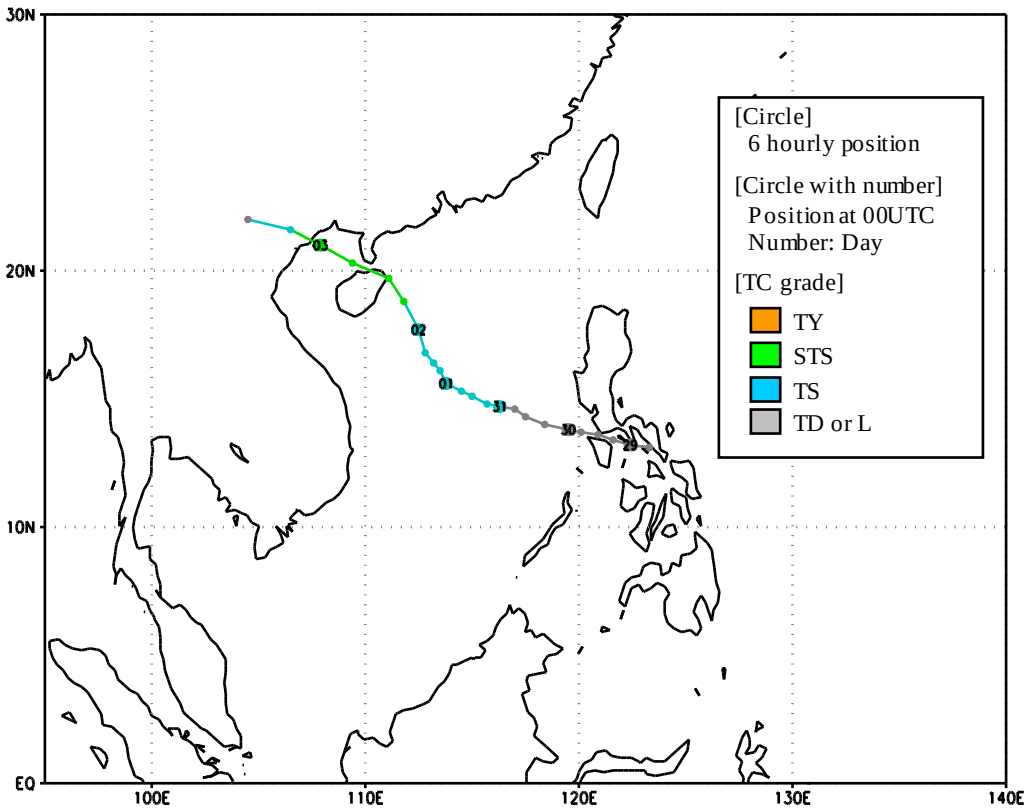
CIMARON (1308)

CIMARON formed as a tropical depression (TD) over the sea east of the Philippines at 06 UTC on 15 July 2013. Moving northwestward, it was upgraded to tropical storm (TS) intensity north of Luzon Island at 00 UTC on 17 July and reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 1000 hPa over the South China Sea 18 hours later. Gradually turning northeastward on 18 July, CIMARON weakened to TD intensity over the Taiwan Strait at 18 UTC the same day and dissipated six hours later.



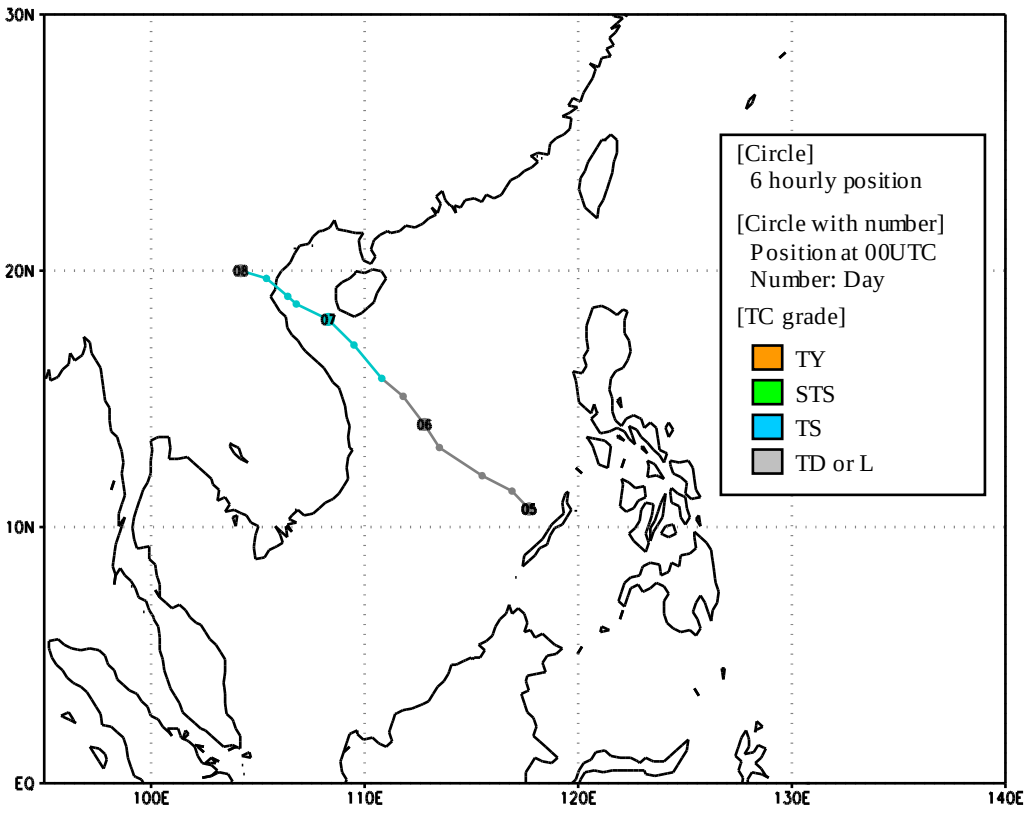
JEBI (1309)

JEBI formed as a tropical depression (TD) near the southern coast of Luzon Island at 18 UTC on 28 July 2013. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity over the South China Sea at 00 UTC on 31 July. Moving northwestward, JEBI 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 over the sea east of Hainan Island at 06 UTC on 2 August. After crossing the northern part of the island and the Gulf of Tonkin, it weakened to TD intensity over the northern part of Viet Nam at 12 UTC on 3 August and dissipated six hours later.



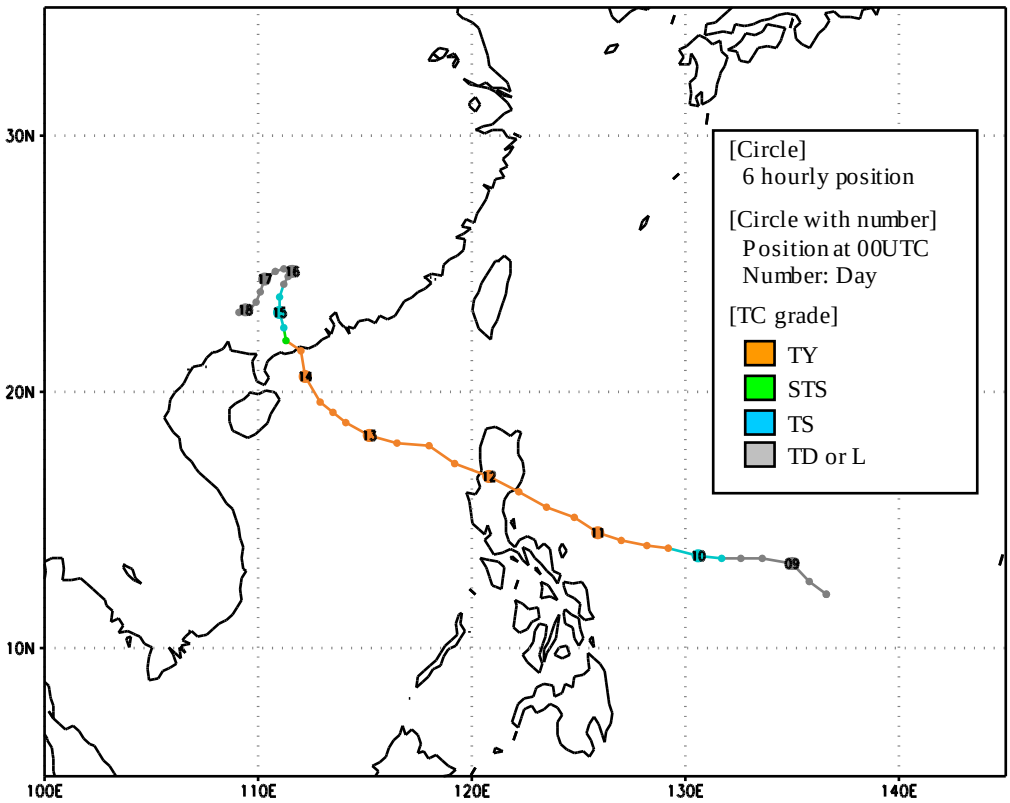
MANGKHUT (1310)

MANGKHUT formed as a tropical depression (TD) over the sea north of Palawan Island at 00 UTC on 5 August 2013 and moved northwestward. Keeping its northwestward track, it was upgraded to tropical storm (TS) intensity over the sea south of Hainan Island at 12 UTC the next day. MANGKHUT reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 992 hPa over the Gulf of Tonkin at 06 UTC on 7 August. It hit the northern part of Viet Nam before 18 UTC the same day. MANGKHUT was weakened to TD intensity over the northern part of Laos at 00 UTC the next day and dissipated six hours later.



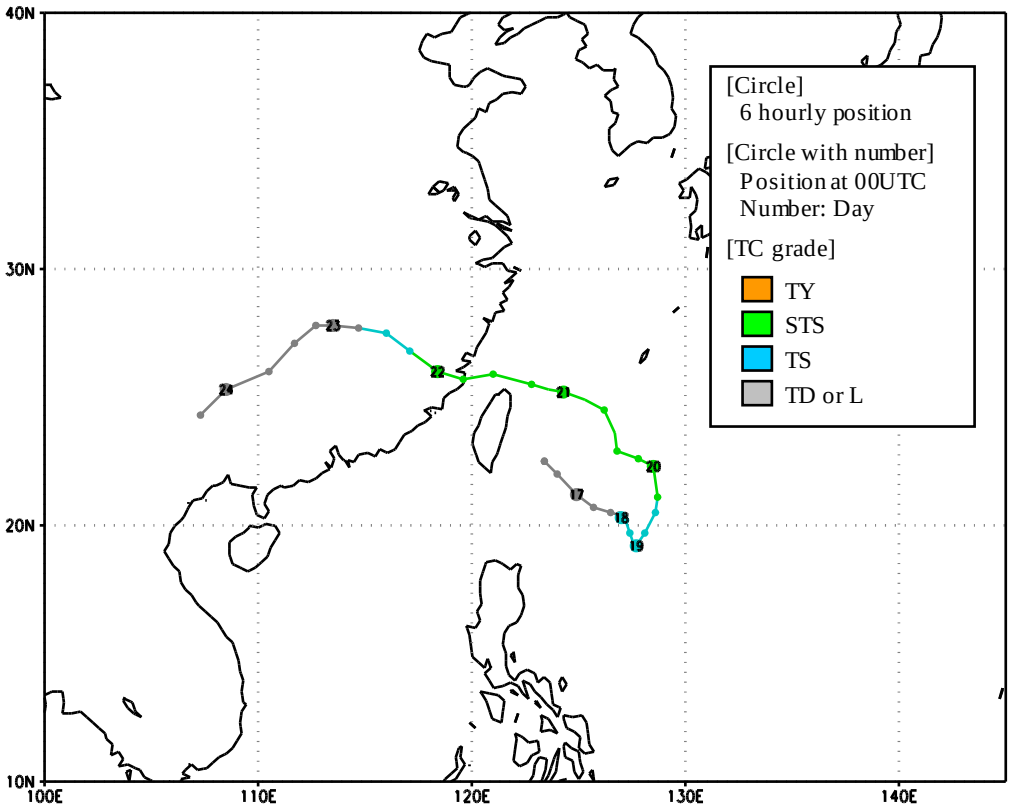
UTOR (1311)

UTOR formed as a tropical depression (TD) northwest of the Yap Islands at 12 UTC on 8 August 2013. Moving westward, it was upgraded to tropical storm (TS) intensity east of the Philippines at 18 UTC the next day. UTOR rapidly developed and was upgraded to typhoon (TY) intensity over the same waters at 06 UTC on 10 August. Turning west-northwestward on 11 August, it reached its peak intensity with maximum sustained winds of 105 kt and a central pressure of 925 hPa east of Luzon Island at 12 UTC the same day. After hitting the island late the same day, UTOR kept its west-northwestward track and TY intensity over the South China Sea. It turned northward on 14 August and hit the southern part of China with TY intensity after 06 UTC the same day. UTOR weakened to TD intensity on 12 UTC the next day and slowly moved over the southern part of China before dissipating at 12 UTC on 18 August.



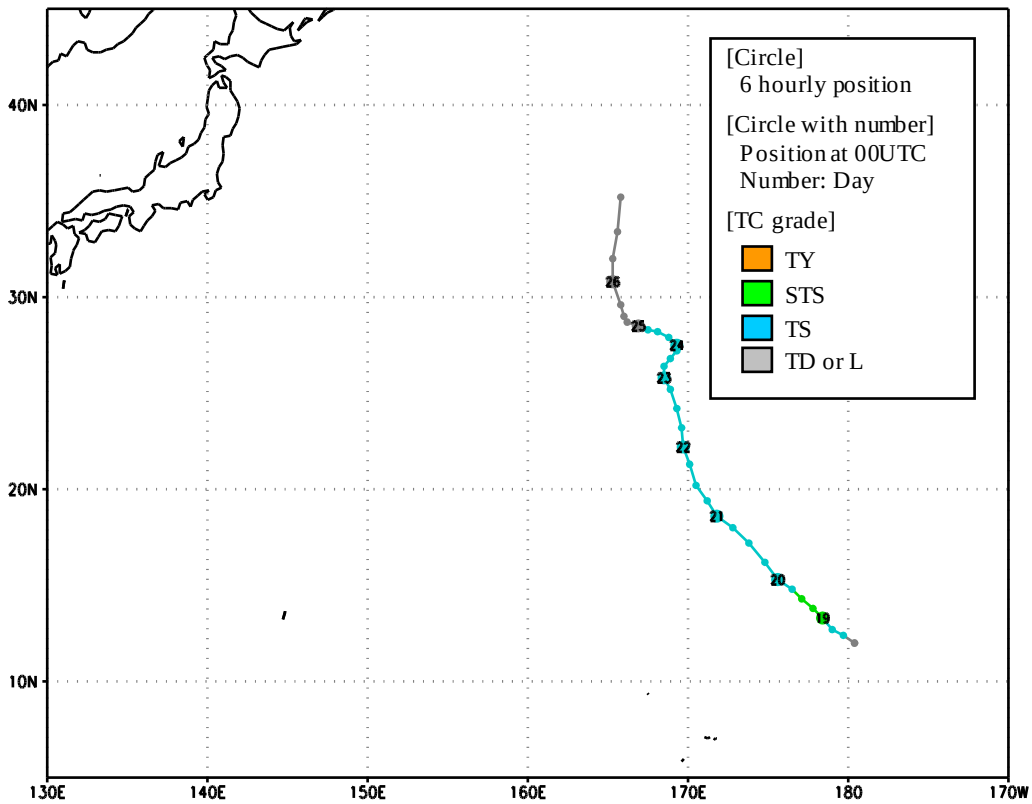
TRAMI (1312)

TRAMI formed as a tropical depression (TD) east of Taiwan Island at 12 UTC on 16 August 2013. Moving southeastward, it was upgraded to tropical storm (TS) intensity south of Okinawa Island. TRAMI turned northward on 19 August and turn northwestward the next day again. It reached its peak intensity with maximum sustained winds of 60 kt and a central pressure of 965 hPa near Miyakojima Island at 21 UTC on 20 August. After moving westward over the East China Sea, TRAMI hit China with severe tropical storm (STS) intensity late on 21 August. Moving west-northwestward, it weakened to TD intensity over the central part of China at 18 UTC on 22 August. Turning southwestward, TRAMI dissipated over the southern part of China at 12 UTC on 24 August.



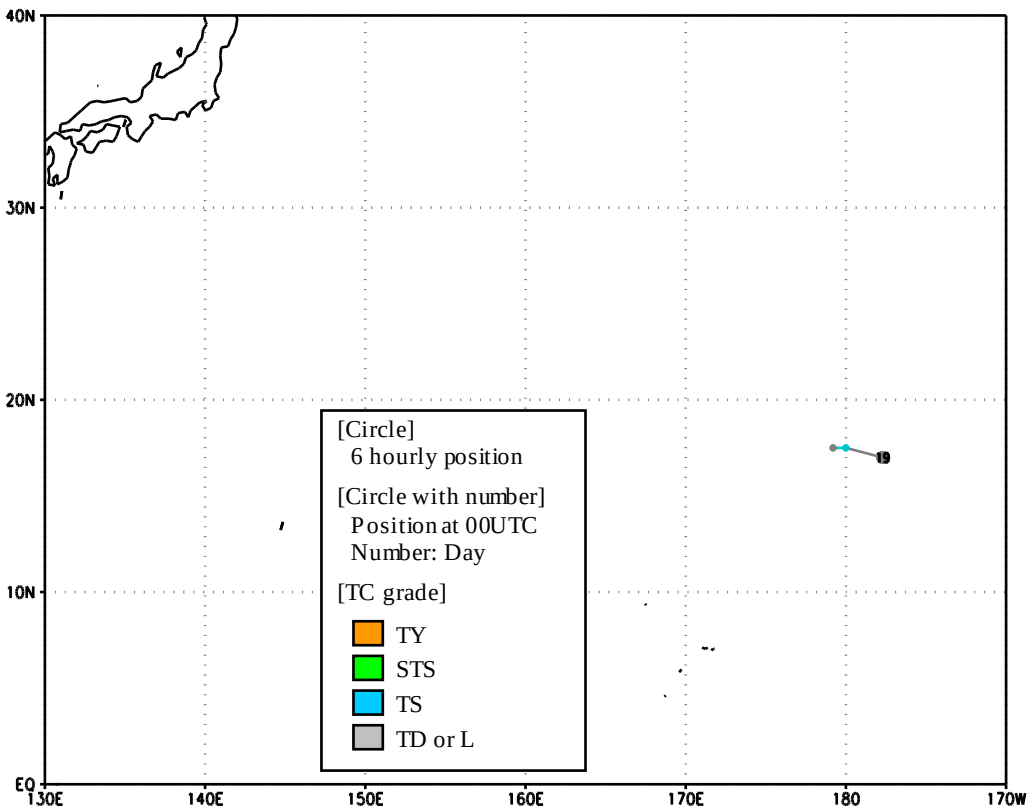
PEWA (1313)

PEWA moved northwestward and crossed longitude 180 degrees east with tropical storm (TS) intensity over the sea east of the Marshall Islands before 12 UTC on 18 August 2013. Moving northwestward, it was upgraded to severe tropical storm (STS) intensity and reached its peak intensity with maximum sustained winds of 55 kt and a central pressure of 990 hPa over the same waters at 00 UTC the next day. Keeping its northwestward track, PEWA was downgraded to TS intensity east of Wake Island 18 hours later. Turning north-northwestward, it weakened to tropical depression (TD) intensity over the sea far east of Japan at 00 UTC on 25 August and dissipated over the same waters at 00 UTC on 27 August.



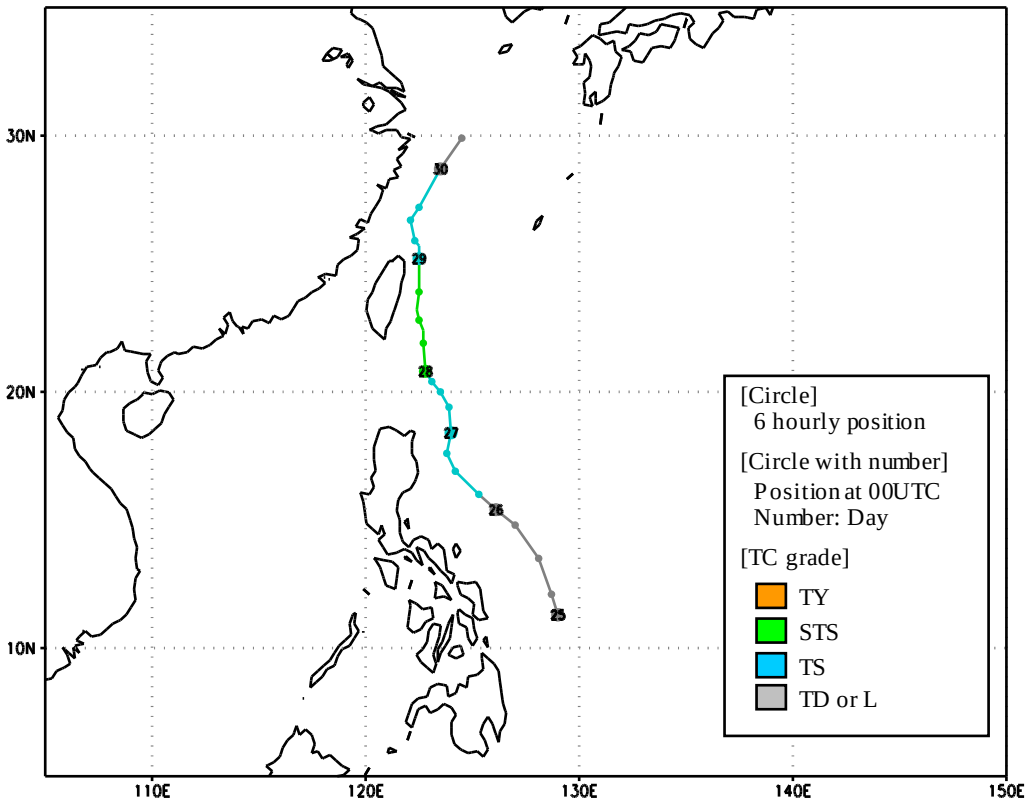
UNALA (1314)

UNALA moved westwards and crossed longitude 180 degrees east with tropical storm (TS) intensity over the sea east of Wake Island around 06 UTC on 19 August 2013 with maximum sustained winds of 35 kt and a central pressure of 1000 hPa. UNALA weakened to TD intensity over the same waters at 12 UTC the same day and dissipated six hours later.



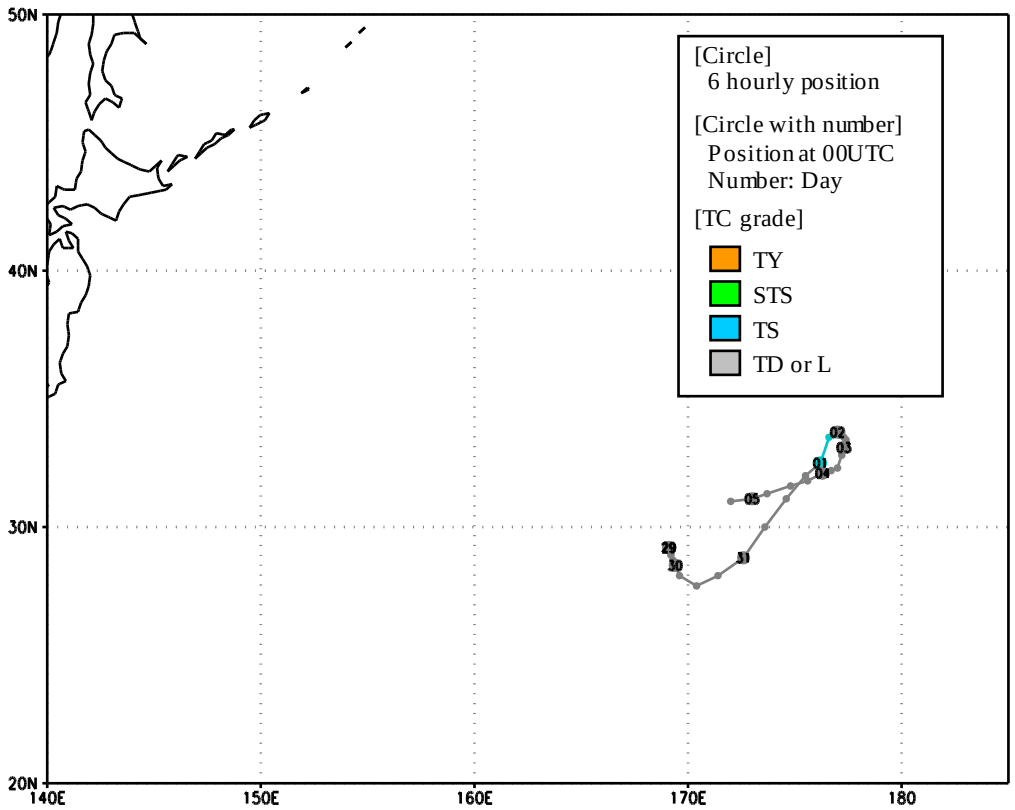
KONG-REY (1315)

KONG-REY formed as a tropical depression (TD) east of the Philippines at 00 UTC on 25 August 2013 and moved north-northwestward. It was upgraded to tropical storm (TS) intensity east of Luzon Island at 06 UTC the next day before tuning northward. KONG-REY was upgraded to severe tropical storm (STS) intensity southeast of Taiwan Island at 00 UTC on 28 August. Keeping its northward track, it reached its peak intensity with maximum sustained winds of 55 kt and a central pressure of 980 hPa east of the island at 12 UTC the same day. After entering the East China Sea, KONG-REY was downgraded to TS intensity at 00 UTC on 29 August and turned northeastward the same day. It weakened to TD intensity at 00 UTC the next day and dissipated 12 hours later.



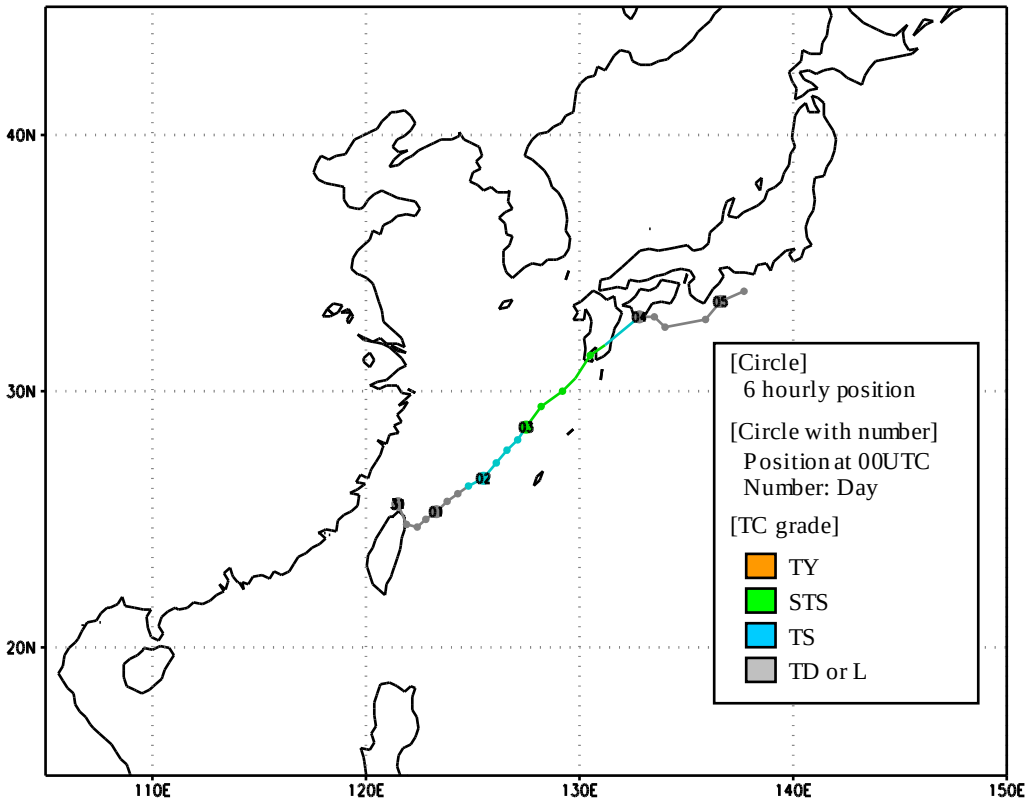
YUTU (1316)

YUTU formed as a tropical depression (TD) north of Wake Island at 00 UTC on 29 August 2013 and moved southeastward. It turned northeastward over the same waters the next day. YUTU was upgraded to tropical storm (TS) intensity northwest of the Midway Islands at 00 UTC on 1 September when it reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 1002 hPa. YUTU soon weakened to TD intensity over the same waters 18 hours later. It turned southward early on 2 September and turned west-southwestward the next day again. YUTU dissipated west-northwest of the Midway Islands at 12 UTC on 5 September.



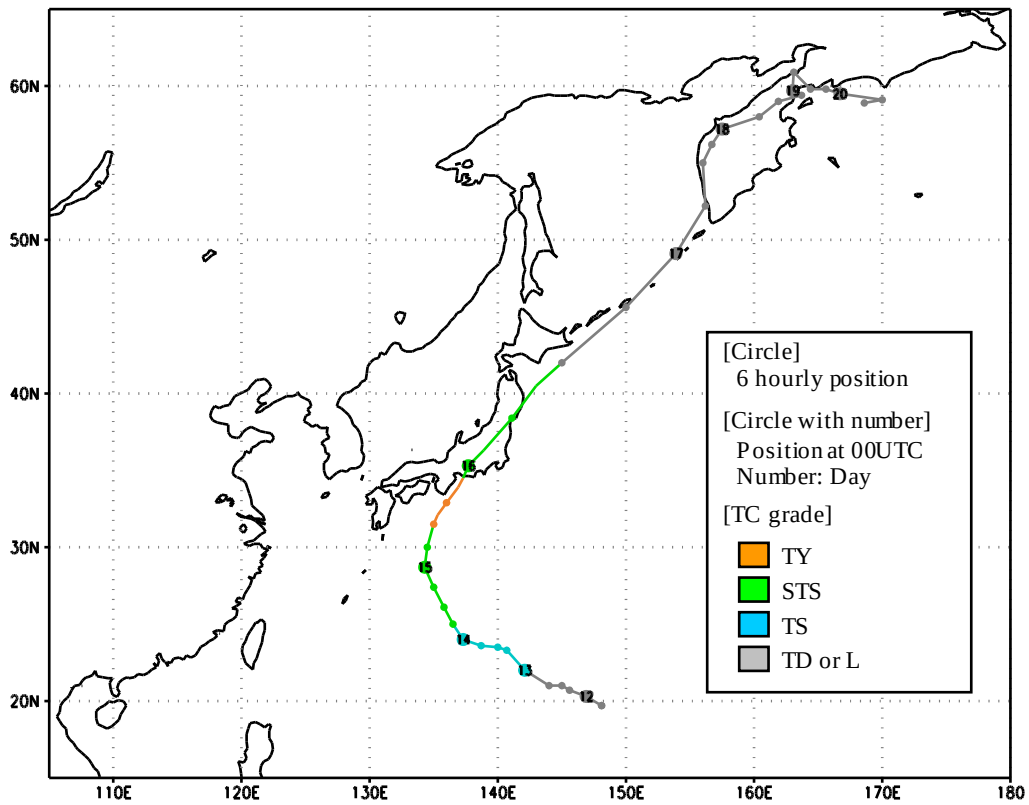
TORAJI (1317)

TORAJI formed as a tropical depression (TD) off the northern coast of Taiwan Island at 00 UTC on 31 August 2013 and moved southeastward. It was upgraded to tropical storm (TS) intensity over the sea north of the Sakishima Islands at 18 UTC on 1 September after turning northeastward. Keeping its northeastward track, TORAJI 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 west of the Amami Islands at 00 UTC on 3 September. After landing on Kyushu Island with STS intensity late that day, it transformed into an extratropical cyclone over the southwestern part of Shikoku Island six hours later. Moving east-northeastward, TORAJI dissipated east of the Kii Peninsula at 12 UTC on 5 September.



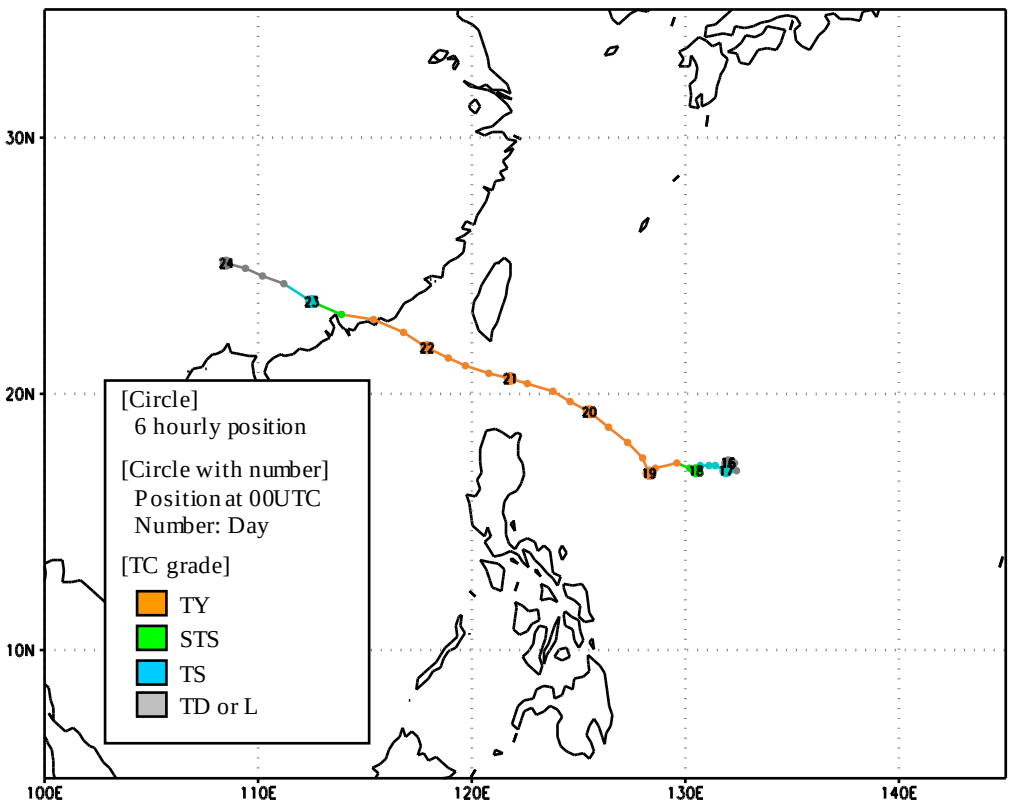
MAN-YI (1318)

MAN-YI formed as a tropical depression (TD) east of the Mariana Islands at 18 UTC on 11 September 2013. Moving northwestward, it was upgraded to tropical storm (TS) intensity south of Chichijima Island at 00 UTC on 13 September. Gradually turning north-northeastward, MAN-YI was upgraded to typhoon (TY) intensity and reached its peak intensity with maximum sustained winds of 65 kt and a central pressure of 960 hPa south of Shikoku Island at 12 UTC on 15 September. It made landfall on Honshu Island with severe tropical storm (STS) intensity late the same day. Keeping its northeastward track, MAN-YI transformed into an extratropical cyclone southeast of Hokkaido Island at 12 UTC the next day. It moved northeastward along the Chishima Islands and crossed the Kamchatka Peninsula. MAN-YI dissipated over the Bering Sea at 18 UTC on 20 September.



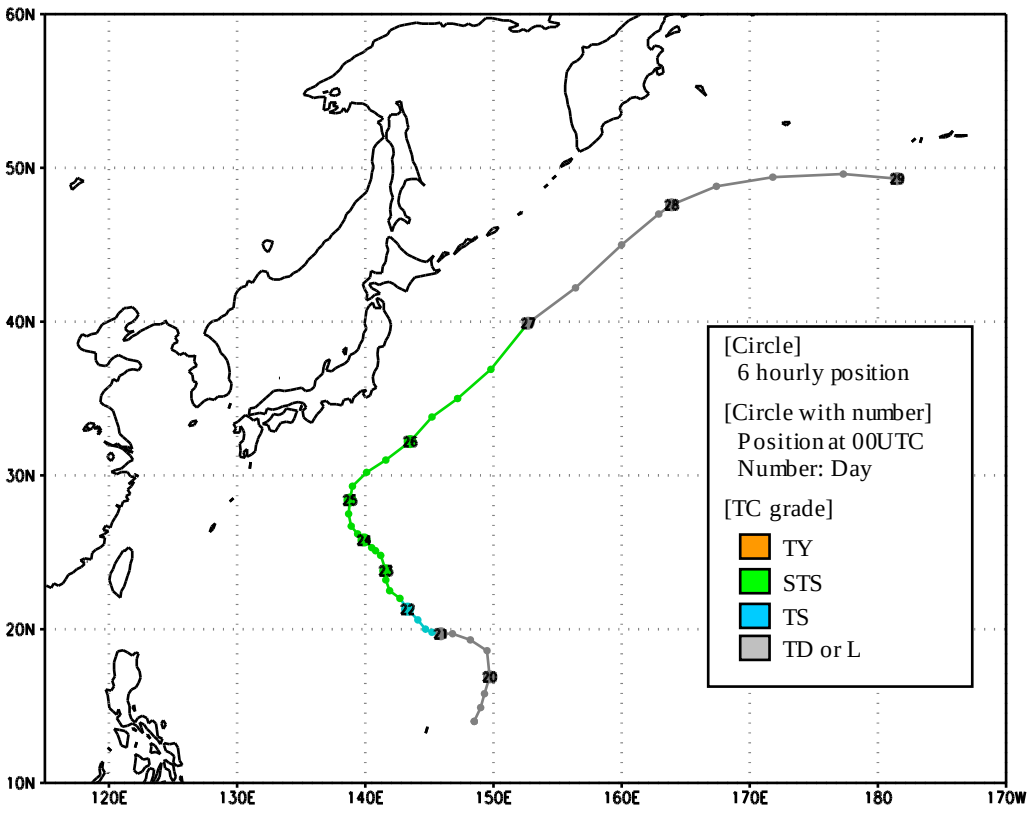
USAGI (1319)

USAGI formed as a tropical depression (TD) southwest of Okinotorishima Island at 00 UTC on 16 September 2013 and moved slowly eastward. After turning westward over the same waters, it was upgraded to tropical storm (TS) intensity at 18 UTC the same day. Moving slowly westward, USAGI was upgraded to typhoon (TY) intensity east of the Philippines at 12 UTC on 18 September. It rapidly developed and reached its peak intensity with maximum sustained winds of 110 kt and a central pressure of 910 hPa over the same waters at 18 UTC the next day. Keeping its west-northwestward track, USAGI passed through the Luzon Strait and entered the South China Sea on 21 September. It hit the southern part of China with TY intensity the next day and was downgraded to TS intensity at 00 UTC on 23 September. Maintaining its west-northwestward track, USAGI weakened to TD intensity at 06 UTC the same day and dissipated at 06 UTC the next day.



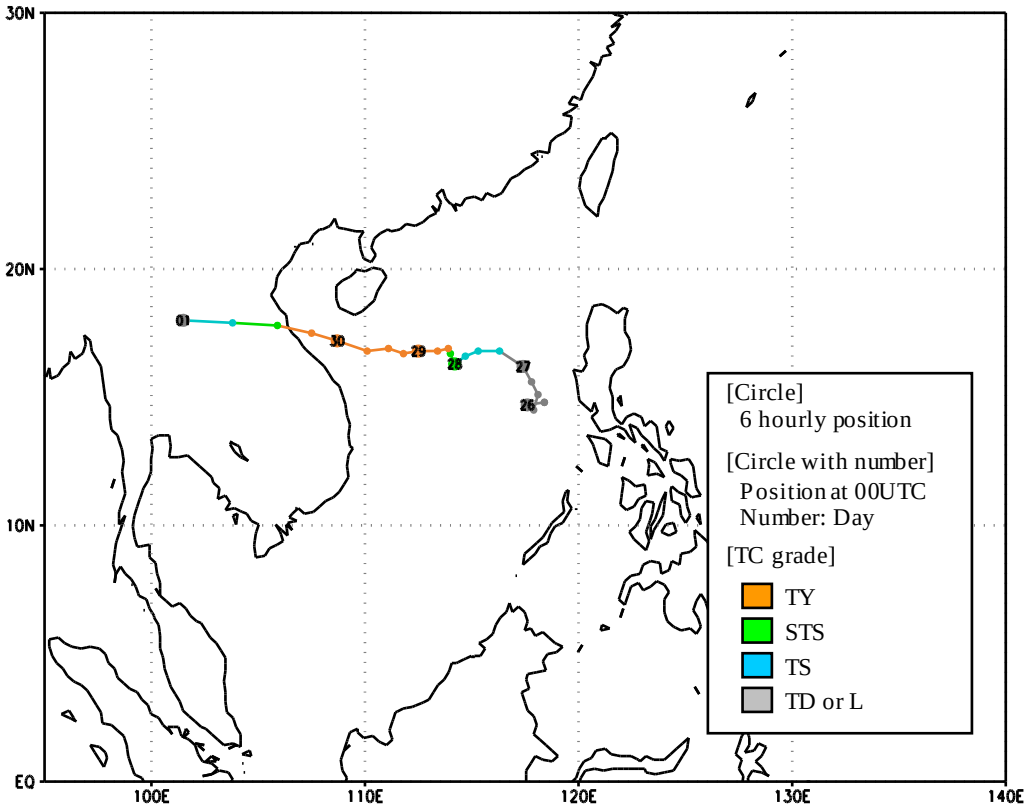
PABUK (1320)

PABUK formed as a tropical depression (TD) east of the Mariana Islands at 06 UTC on 19 September 2013 and moved northward. It turned northwestward northeast of the islands the next day. PABUK was upgraded to tropical storm (TS) intensity around the islands at 06 UTC on 21 September. Keeping its northwestward track, it was upgraded to severe tropical storm (STS) intensity south of the Ogasawara Islands at 06 UTC the next day. PABUK reached its peak intensity with maximum sustained winds of 60 kt and a central pressure of 965 hPa west of the islands at 12 UTC on 24 September and turned northeastward the next day. Accelerating northeastward, PABUK transformed into an extratropical cyclone east of Japan at 00 UTC on 27 September. It crossed longitude 180 degrees east near the Aleutian Islands before 00 UTC on 29 September.



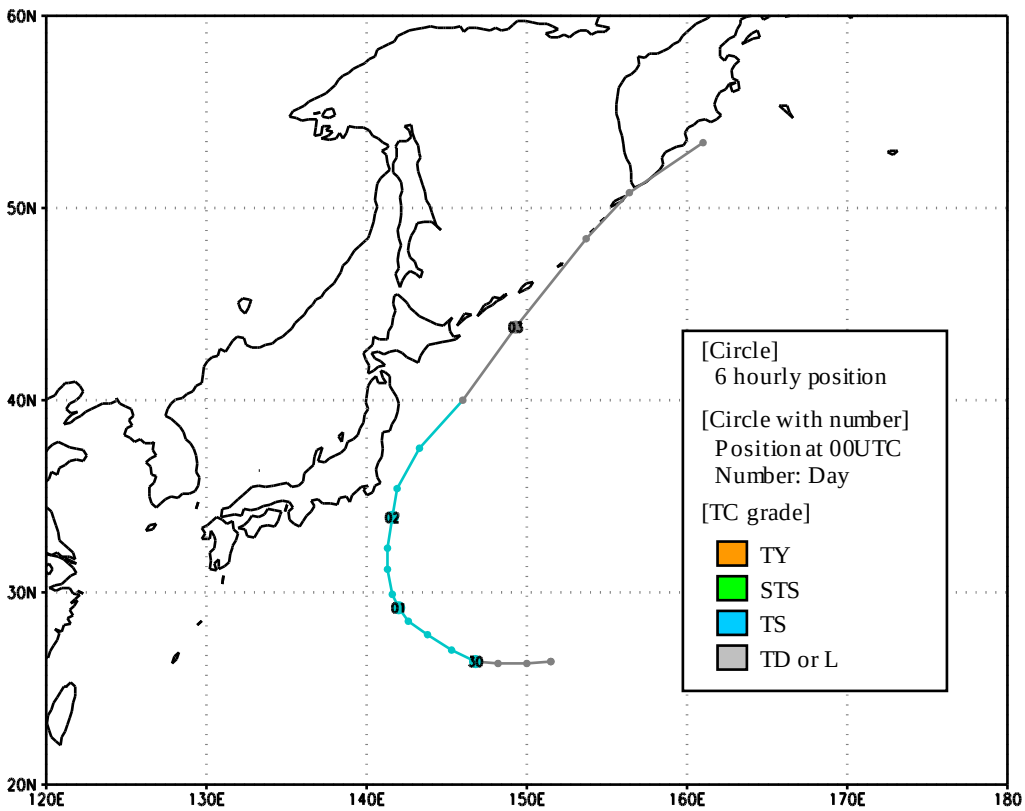
WUTIP (1321)

WUTIP formed as a tropical depression (TD) over the sea west of Luzon Island at 18 UTC on 25 September 2013. After moving west-southwestward and turning in a counterclockwise direction to circle, it was upgraded to tropical storm (TS) intensity over the South China Sea at 06 UTC on 27 September. Moving westward, WUTIP 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 06 UTC on 29 September. After hitting the northern part of Viet Nam with TY intensity, it was downgraded to TS intensity at 18 UTC the next day. Keeping its westward track, WUTIP weakened to TD intensity over Laos at 00 UTC on 1 October and dissipated six hours later.



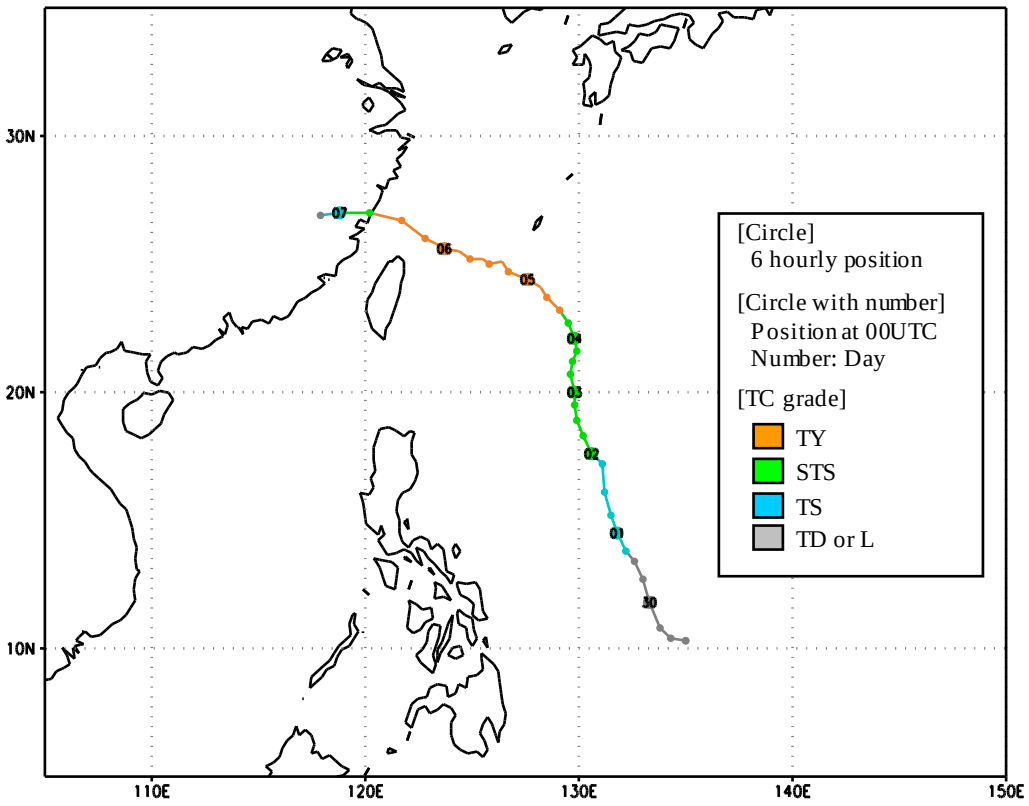
SEPAT (1322)

SEPAT formed as a tropical depression (TD) over the sea east of the Ogasawara Islands at 06 UTC on 29 September 2013. It was upgraded to tropical storm (TS) intensity over the same waters at 00 UTC the next day and then turned northward. SEPAT reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 992 hPa east of Japan at 06 UTC on 2 October. After turning northeastward, it transformed into an extratropical cyclone over the same waters at 18 UTC the same day. SEPAT accelerated northeastward and moved along the Chishima Islands. It dissipated over the sea east of the Kamchatka Peninsula at 00 UTC on 4 October.



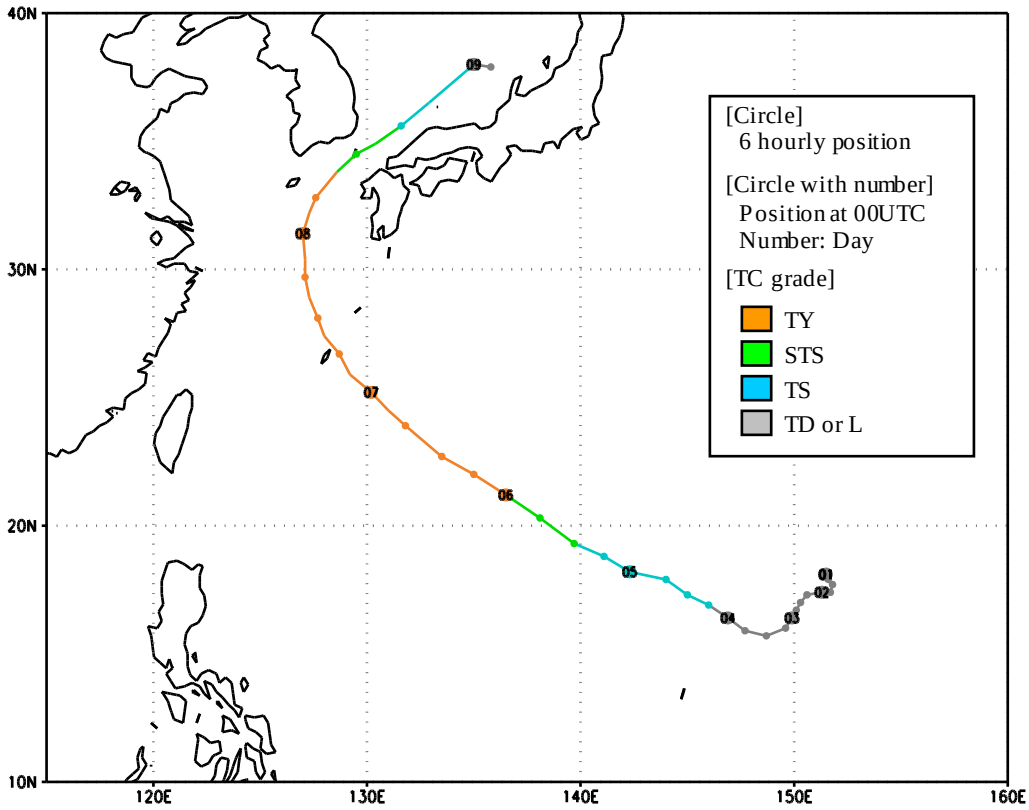
FITOW (1323)

FITOW formed as a tropical depression (TD) north of the Palau Islands at 06 UTC on 29 September 2013. Moving north-northwestward, it was upgraded to tropical storm (TS) intensity east of the Philippines at 18 UTC the next day. FITOW gradually developed before turning west-northwestward on 4 October. It was upgraded to typhoon (TY) intensity south of Okinawa Island at 12 UTC the same day and reached its peak intensity with maximum sustained winds of 75 kt and a central pressure of 960 hPa six hours later. Keeping its west-northwestward track, FITOW passed near Miyakojima Island and entered the East China Sea on 5 October. After hitting the southeastern part of China late the next day, it was downgraded to TS intensity at 00 UTC on 7 October. Moving westward, FITOW weakened to TD intensity at 06 UTC the same day and dissipated six hours later.



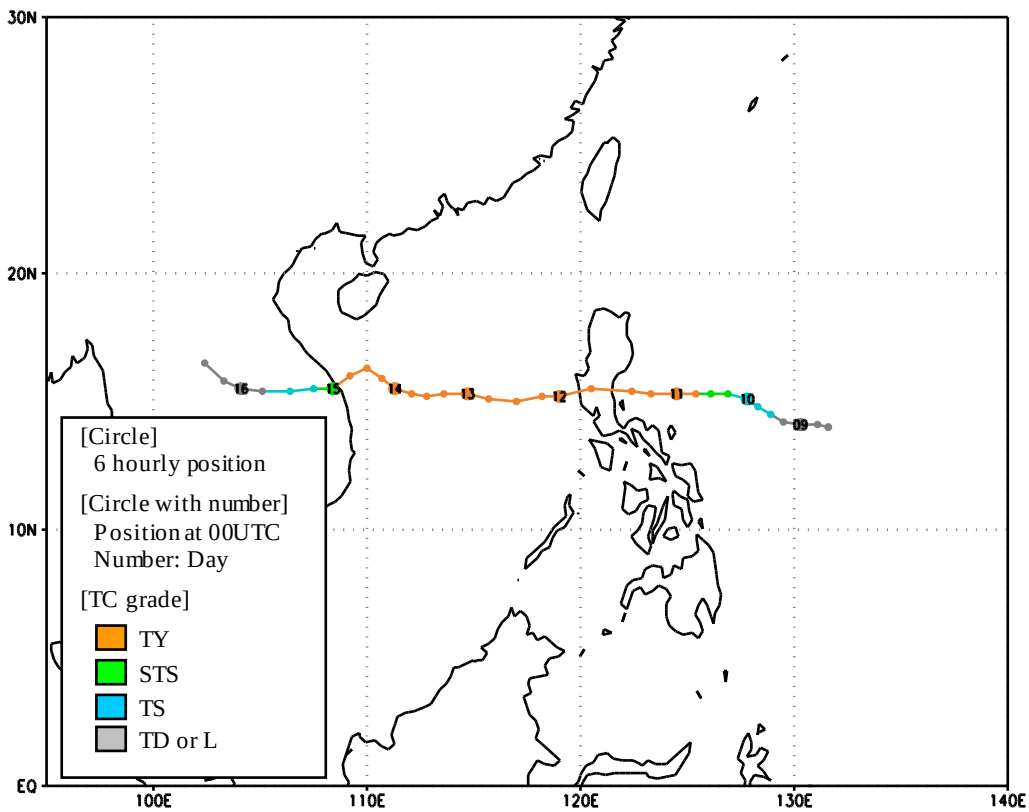
DANAS (1324)

DANAS formed as a tropical depression (TD) over the sea east of the Mariana Islands at 00 UTC on 1 October 2013 and slowly moved southwestward. It turned northwestward southeast of the Mariana Islands late on 3 October. DANAS was upgraded to tropical storm (TS) intensity around the Mariana Islands at 06 UTC on 4 October and was upgraded to typhoon (TY) intensity south of Japan at 00 UTC on 6 October. Keeping its northwestward track, it reached its peak intensity with maximum sustained winds of 90 kt and a central pressure of 935 hPa southwest of Minamidaitojima Island at 00 UTC on 7 October and entered the East China Sea that day. DANAS gradually turned northeastward over the same waters and entered into the Sea of Japan on 8 October. It transformed into an extratropical cyclone over the same waters at 00 UTC the next day and dissipated 12 hours later.



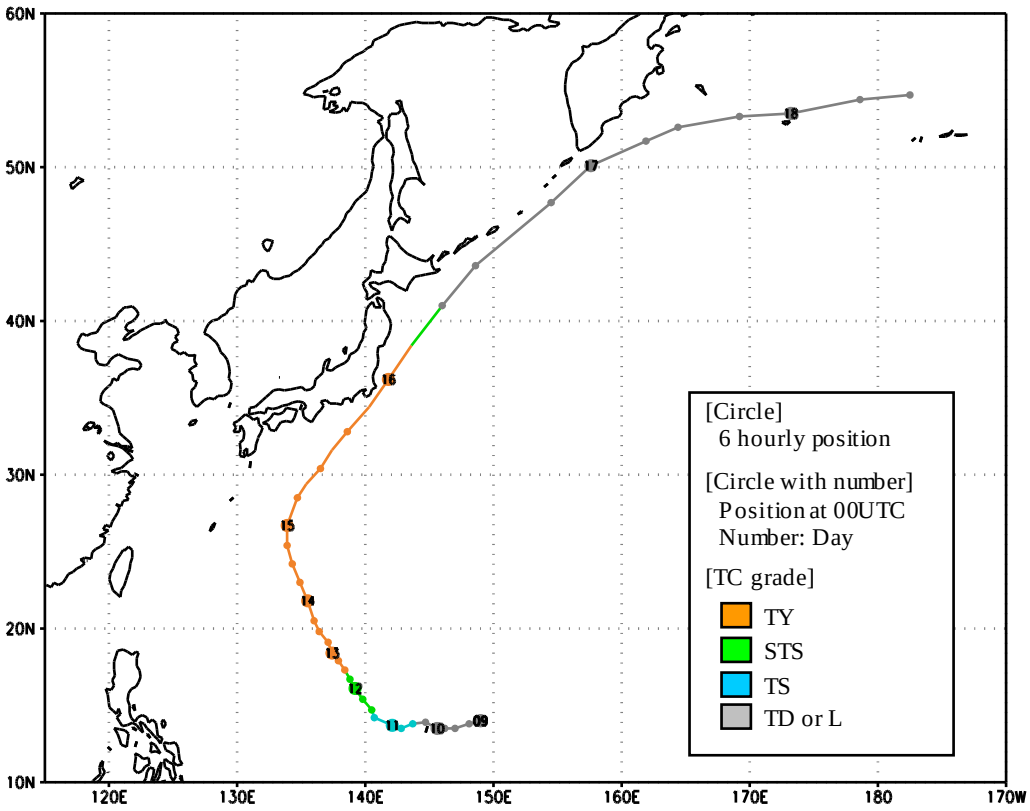
NARI (1325)

NARI formed as a tropical depression (TD) over the sea east of the Philippines at 12 UTC on 8 October 2013. Moving westward, it was upgraded to tropical storm (TS) intensity over the same waters 24 hours later. Keeping its westward track, NARI was upgraded to typhoon (TY) intensity east of Luzon Island at 18 UTC on 10 October. After crossing the island with TY intensity, it reached its peak intensity with maximum sustained winds of 75 kt and a central pressure of 965 hPa over the South China Sea at 18 UTC on 12 October. After hitting the central part of Viet Nam, NARI was downgraded to TS intensity at 06 UTC on 15 October. Keeping its westward track, it weakened to TD intensity over Thailand at 18 UTC that day and dissipated 24 hours later.



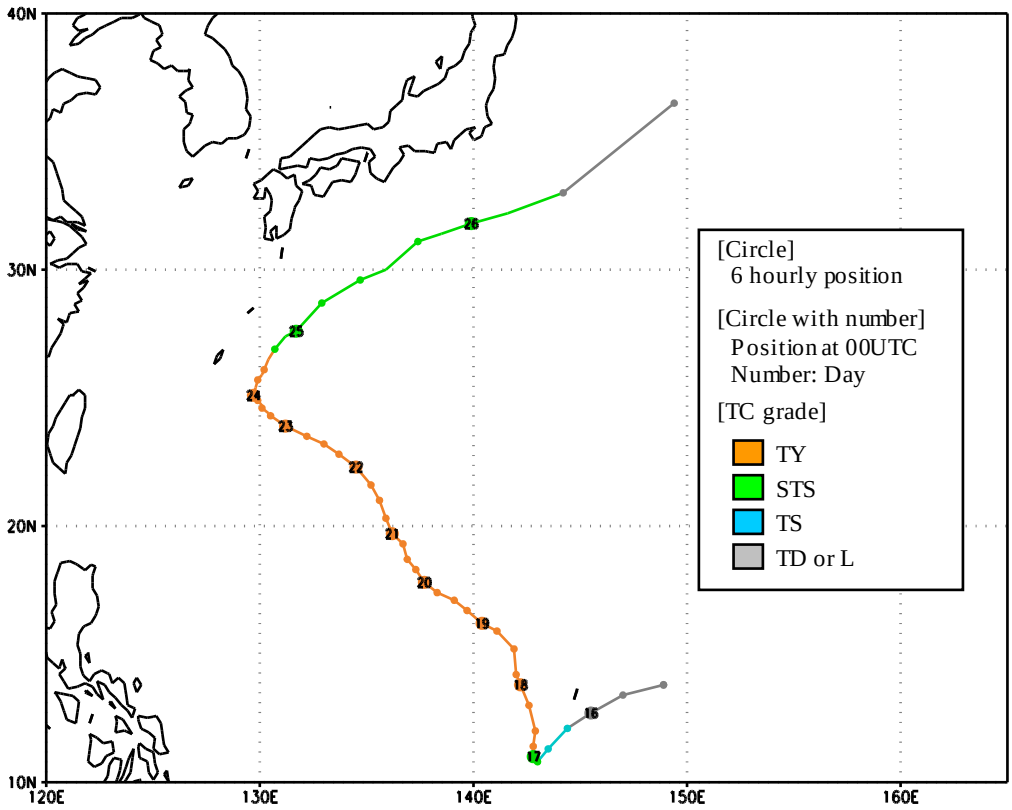
WIPHA (1326)

WIPHA formed as a tropical depression (TD) east of the Mariana Islands at 00 UTC on 9 October 2013. Moving westward, it was upgraded to tropical storm (TS) intensity west of the islands at 12 UTC the next day. After turning northwestward, WIPHA was upgraded to typhoon (TY) intensity southeast of Okinotorishima Island at 12 UTC on 12 October. Keeping its northwestward track, it reached its peak intensity with maximum sustained winds of 90 kt and a central pressure of 930 hPa near the island at 12 UTC the next day. Turning gradually northeastward, WIPHA passed around the Izu Islands with TY intensity and then transformed into an extratropical cyclone over the sea east of Japan at 06 UTC on 16 October. Keeping its east-northeastward track, it crossed longitude 180 degrees east over the Bering Sea before 12 UTC on 18 October.



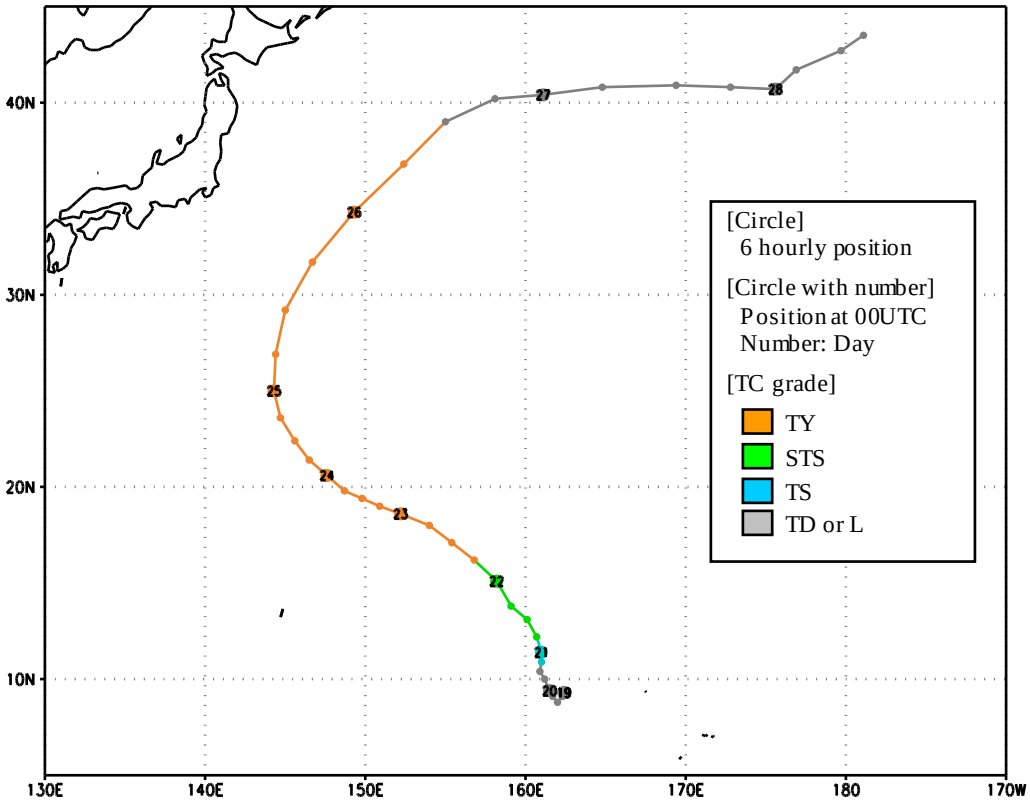
FRANCISCO (1327)

FRANCISCO formed as a tropical depression (TD) east of the Mariana Islands at 12 UTC on 15 October 2013. Moving southwestward, it was upgraded to tropical storm (TS) intensity south of the islands at 06 UTC the next day. After turning northwestward, FRANCISCO was upgraded to typhoon (TY) intensity southwest of the islands at 06 UTC on 17 October. It rapidly developed and reached its peak intensity with maximum sustained winds of 105 kt and a central pressure of 920 hPa west of the islands at 18 UTC the next day. Keeping its northwestward track, FRANCISCO gradually weakened and turned northeastward over the sea east of Okinawa Island on 24 October. Accelerating northeastward, it transformed into an extratropical cyclone east of the Izu Islands at 06 UTC on 26 October and dissipated 12 hours later.



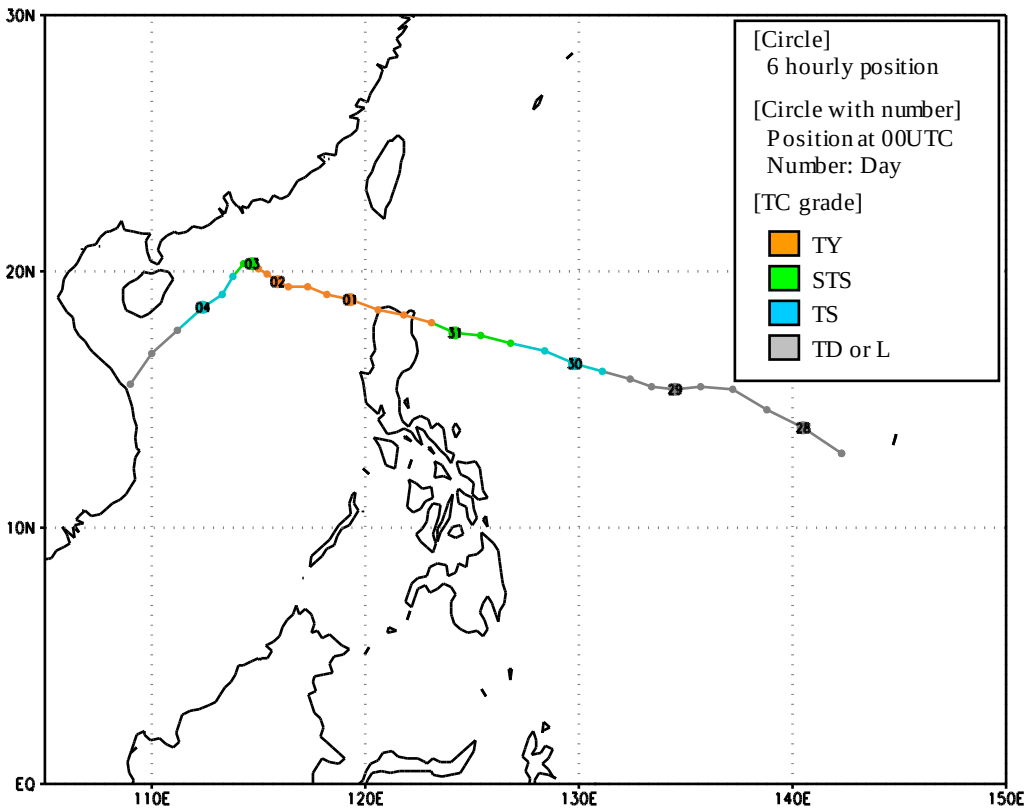
LEKIMA (1328)

LEKIMA formed as a tropical depression (TD) over the sea west of the Marshall Islands at 00 UTC on 19 October 2013 and moved northwestward. It was upgraded to tropical storm (TS) intensity at 18 UTC the next day over the same waters. LEKIMA was upgraded to typhoon (TY) intensity northwest of the islands at 06 UTC on 22 October. It rapidly developed and reached its peak intensity with maximum sustained winds of 115 kt and a central pressure of 905 hPa east of the Mariana Islands at 00 UTC the next day. LEKIMA turned northward southeast of the Ogasawara Islands late on 24 October and accelerated northeastward. It transformed into an extratropical cyclone far east of Japan at 12 UTC on 26 October and moved eastward. It crossed longitude 180 degrees east south of the Aleutian Islands before 18 UTC on 28 October.



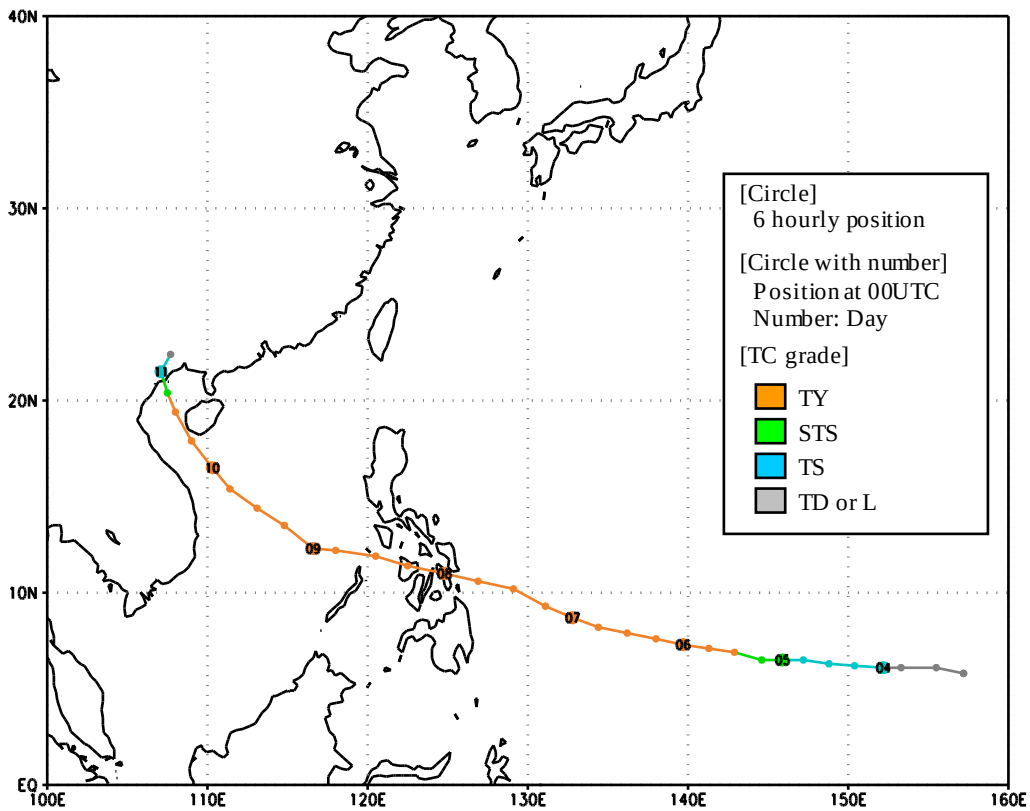
KROSA (1329)

KROSA formed as a tropical depression (TD) over the sea west of the Mariana Islands at 18 UTC on 27 October 2013. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity east of the Philippines at 18 UTC on 29 October. Keeping its west-northwestward track, KROSA was upgraded to typhoon (TY) intensity off the eastern coast of Luzon Island at 06 UTC on 31 October. After crossing the northern part of the island with TY intensity, it reached its peak intensity with maximum sustained winds of 75 kt and a central pressure of 970 hPa over the South China Sea at 18 UTC the next day. After turning southwestward south of Hong Kong, KROSA was downgraded to TS intensity at 12 UTC on 3 November. Keeping its southwestward track, it weakened to TD intensity southeast of Hainan Island at 06 UTC the next day and dissipated off the coast of Viet Nam18 hours later.



HAIYAN (1330)

HAIYAN formed as a tropical depression (TD) over the sea southwest of Pohnpei Island at 06 UTC on 3 November 2013. Moving westward, it was upgraded to tropical storm (TS) intensity south of the Chuuk Islands at 00 UTC the next day. Keeping its westward track, HAIYAN was upgraded to typhoon (TY) intensity over the sea southeast of the Yap Islands at 12 UTC on 5 November and it reached its peak intensity with maximum sustained winds of 125 kt and a central pressure of 895 hPa northeast of Mindanao Island at 12 UTC on 7 November. Moving west-northwestward, HAIYAN crossed the Philippines with TY intensity and entered the South China Sea late the next day. Turning gradually northwestward, it was downgraded to severe tropical storm (STS) intensity over the Gulf of Tonkin at 18 UTC on 10 November. After hitting the northern part of Viet Nam with TS intensity, HAIYAN was downgraded to TD intensity over the southern part of China at 06 UTC the next day and dissipated six hours later.



PODUL (1331)

PODUL formed as a tropical depression (TD) east of Mindanao Island at 12 UTC on 11 November 2013. Moving west-northwestward, it crossed the Philippines and then turned westward over the South China Sea on 14 November. PODUL was upgraded to tropical storm (TS) intensity over the same waters when it reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 1002 hPa at 12 UTC the same day. Soon after hitting Viet Nam, PODUL weakened to TD intensity at 00 UTC on 15 November and dissipated 12 hours later.