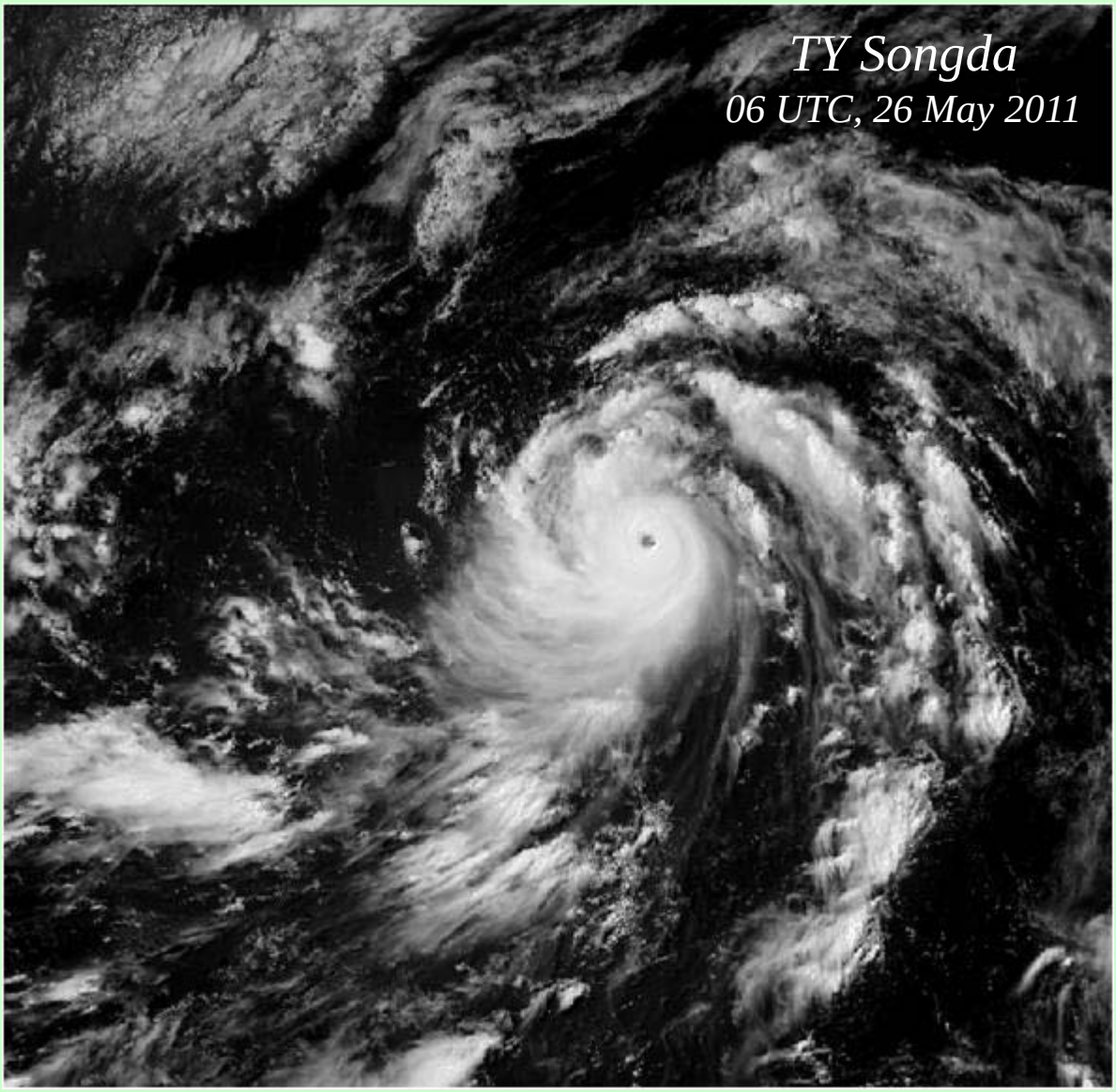
Annual Report on the Activities of the RSMC Tokyo - Typhoon Center 2011



Japan Meteorological Agency

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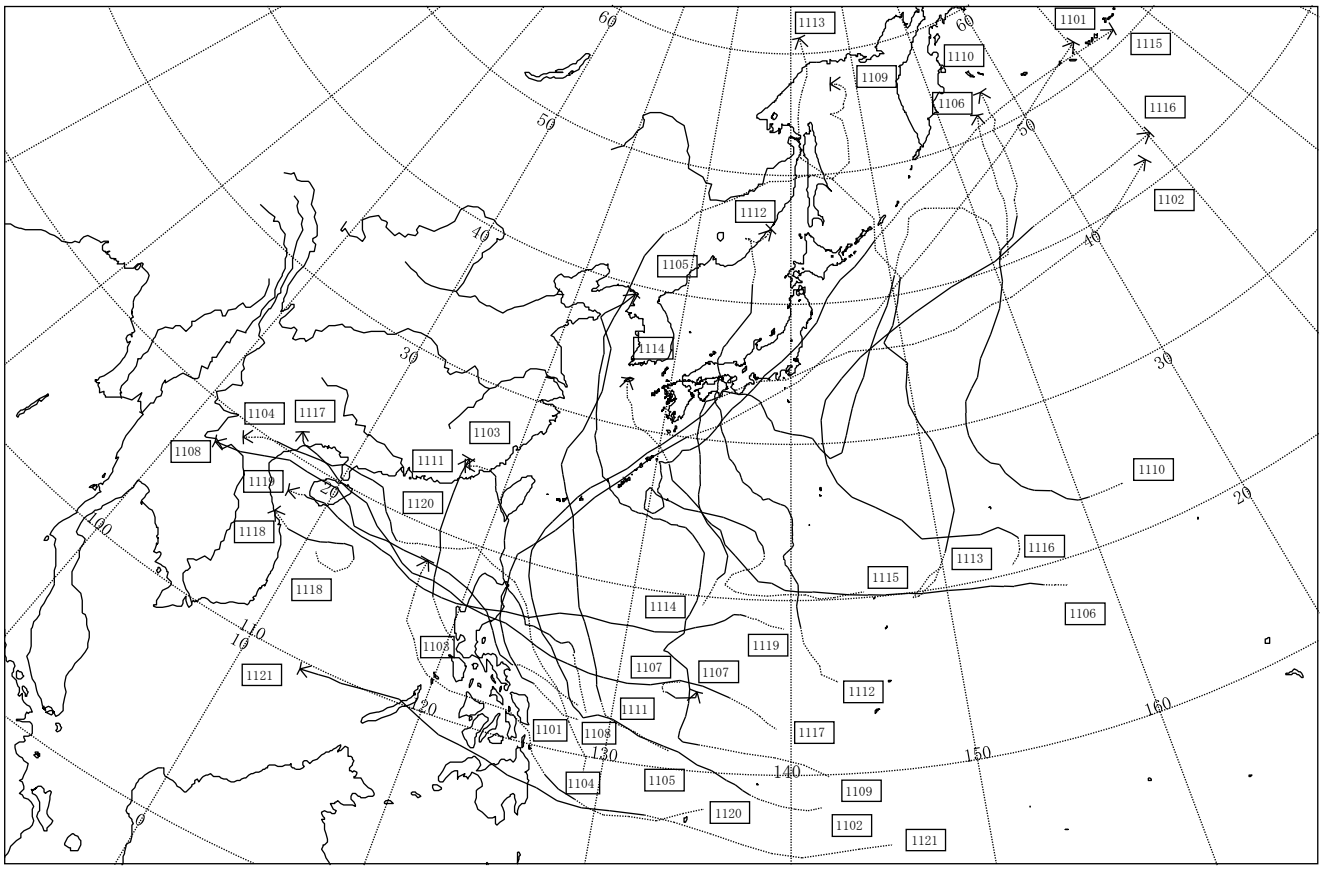

Japan Meteorological Agency

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Introduction

The RSMC Tokyo - Typhoon Center (referred to below 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) Dissemination of the above information to National Meteorological Services (NMSs) in particular to the Members of the ESCAP/WMO Typhoon Committee, 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* to serve as operational references for the NMSs concerned. The report is aimed at summarizing the activities of the Center and reviewing the TCs of the preceding year.

In this issue covering 2011, an outline of routine operations at the Center and its operational products are presented in Chapter 1, while Chapter 2 reports on the major activities of the Center in 2011. Chapter 3 describes atmospheric and oceanic conditions in the tropics and notes the highlights of TC activities in 2011. In Chapter 4, verification statistics of operational forecasts and predictions of the numerical weather prediction (NWP) models of the Center are presented. The best track data for TCs in 2011 are shown in table and chart forms in the appendices. All the relevant texts, tables, charts and appendices are included on the DVD attached to this report.

The DVD contains hourly cloud images of all the TCs in 2011 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 animation and is expected to facilitate efficient post-analysis of TCs and their environments. A setup program and a user manual for the software are also included on the DVD. Appendix 8 shows an outline of the DVD and how to use the software.

Chapter 1

Operations at the RSMC Tokyo - Typhoon Center in 2011

The Center's area of responsibility covers the western North Pacific and the South China Sea (0°-60°N, 100°-180°E) including the marginal seas and adjacent land areas (Figure 1.1). The Center carries out analyses and forecasts of tropical cyclones (TCs) when they are in the area. The Center provides the relevant National Meteorological Services (NMSs) with the RSMC products through such means as the GTS, the AFTN and the Internet.

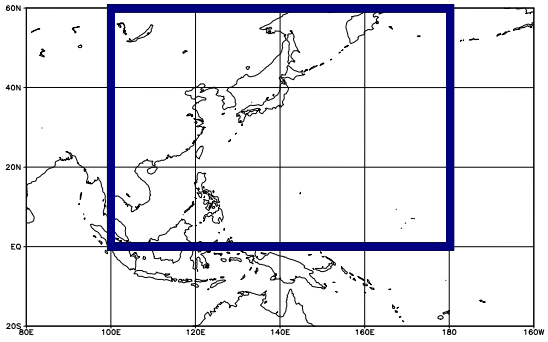


Figure 1.1
Area of responsibility of the RSMC Tokyo - Typhoon Center

1.1 Analysis

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

The central pressure of a TC 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 of winds more than 30 and 50 knots are determined mainly from surface observations, ASCAT observations, 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 uses numerical weather prediction (NWP); the Global Spectral Model (GSM) and the Typhoon Ensemble Prediction System (TEPS). GSM (TL959L60), upgraded on 21 November 2007, has approx. 20 km horizontal resolution and 60 vertical layers while TEPS (TL319L60), which became operational in February 2008, has 11 members with approx. 60 km horizontal resolution and 60 vertical layers. Using mainly TEPS, JMA extended its TC track forecast up to 5 days ahead as from April 2009. Further details and recent improvements on the models are shown in Appendix 6. As for the TC intensity, central pressure and the maximum sustained wind speeds are forecasted based on the results from NWP 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 verification results of recent TC track forecasts.

1.3 Provision of RSMC Products

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

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

The RSMC products are continually issued as long as a TC keeps TS intensity or higher within the 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 the observation times at 00, 03, 06, 09, 12, 15, 18 and 21UTC and reports the following elements in the analysis, 24-, 48- and 72-hour forecasts of a TC:

Analysis	Center position Accuracy of determination of the center position 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 the 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)

In addition to three-day track and intensity forecast, five-day track forecast was started in April 2009. The RSMC Tropical Cyclone Advisory for Five-day Track Forecast is issued four times a day after the observation times at 00, 06, 12 and 18UTC including the following elements in the analysis, 24-, 48-, 72-, 96- and 120-hour forecasts of a TC:

Analysis	Center position Accuracy of determination of the center position 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 the 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 the 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 GSM predictions; GSM is run four times a day with initial analyses at 00, 06, 12 and 18 UTC. The Guidance presents GSM's six-hourly predictions of a TC up to 84 hours ahead and TEPS mean six-hourly prediction up to 132 hours ahead. It includes 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 TC analysis including intensity information (i.e. the CI number) based on the Dvorak method. It is issued a half to one hour after observations at 00, 03, 06, 09, 12, 15, 18 and 21 UTC, and contains following elements:

MTSAT imagery analysis	Center position Accuracy of determination of the center position Direction and speed of movement Mean diameter of the overcast cloud Apparent change in intensity in the last 24 hours** 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**

*** These parameters are 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 provides a brief reasoning for a TC forecast. It is issued at 00 and 06 UTC following the issuance of the RSMC Tropical Cyclone Advisory. In the bulletin, general comments on the forecasting method, 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 provides post-analysis data on TCs of TS intensity or higher. It contains the center position, the central pressure and the maximum sustained wind speed. The best track for a TC is usually finalized one and a half months after the termination of issuance of the above RSMC bulletins for the TC.

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

The Center, as one of the Tropical Cyclone Advisory Centres within the framework of the International Civil Aviation Organization (ICAO), provides Tropical Cyclone Advisory for SIGMET to Meteorological Watch Offices (MWOs) to support their preparations of SIGMET information on TCs. It includes the following elements in the analysis and the 6-, 12-, 18- and 24-hour forecasts***:

*** *6- and 18-hour forecasts are added from 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 upgraded to WMO Information System

As designated in Sixteenth WMO Congress in June 2011, RSMC Tokyo –Typhoon Center has started its operation service of Data Collection or Production Center (DCPC) under the Global Information System Center (GISC) Tokyo since August 2011. It provides NWP products such as predicted fields in grid-point-value (GPV) form and observational data through WIS Data Discovery, Access and Retrieval (DAR) through a new server of GISC Tokyo (http://www.wis-jma.go.jp/). JMA's GSM product at 0.5 degree resolution and 0.25 degree resolution (surface layer) and JMA SATAID Service (http://www.wis-jma.go.jp/cms/sataid/) are also available at the server through WIS DAR. All the products at the new server are listed in Appendix 7. At the end of March 2012, RSMC Data Serving System is to be terminated accordingly.

1.5 RSMC Tokyo - Typhoon Center Website

The RSMC Tokyo - Typhoon Center Website provides TC advisories on a real-time basis, as well as

a wide variety of products including TC analysis archives, technical reviews and annual reports on the activities of the Center. The website address is:

http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.htm.

1.6 Numerical Typhoon Prediction Website

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

- TC track predictions, in table and chart format, of the participating NWP centers with several useful functions such as deriving an ensemble mean from any combination of predictions by the centers
- Weather charts of the NWP models of the participating NWP centers (up to 72 hours)
- JMA's operational TC analysis using satellite image (conventional Dvorak analysis and Early-stage Dvorak analysis)
- Storm surge distribution maps for the Typhoon Committee region
- Time series charts of storm surge and tides (to be provided from 2012 typhoon season)

Chapter 2

Major Activities of the RSMC Tokyo - Typhoon Center in 2011

2.1 Dissemination of RSMC Products

The Center provides operational products for tropical cyclone (TC) forecasting to NMSs via such networks as the GTS and the AFTN. Its monthly and annual totals of issuance of the products in 2011 are listed in Table 2.1.

Table 2.1 Monthly and annual total numbers of products issued by the RSMC Tokyo - Typhoon Center in 2011

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
IUCC10	0	0	0	5	104	103	187	252	315	58	0	46	1070
WTPQ20-25	0	0	0	11	110	133	208	275	357	73	0	63	1230
WTPQ30-35	0	0	0	3	28	30	51	71	88	18	0	15	304
WTPQ50-55	0	0	0	0	30	11	66	90	72	15	0	11	295
FXPQ20-25	0	0	0	4	108	122	204	268	348	70	0	60	1184
FKPQ30-35	0	0	0	5	60	60	95	132	173	34	0	30	589
AXPQ20	0	0	0	0	0	2	3	3	2	4	6	0	20

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 Publication

In March 2011, *the thirteenth issue of the RSMC Technical Review* was issued with the following three topics.

1. Estimation of Tropical Cyclone Intensity Using Aqua/AMSR-E Data
2. Quantitative Precipitation Estimation and Quantitative Precipitation Forecasting by the Japan Meteorological Agency

In December 2011, the Center published the *Annual Report on the Activities of the RSMC Tokyo - Typhoon Center in 2010*. Both of the publications are available on the website.

2.3 Monitoring of Observational Data Availability

The Center carried out regular monitoring of information exchange for enhanced TC observations in accordance with the standard procedures stipulated in Section 6.2, Chapter 6 of *The Typhoon Committee Operational Manual (TOM) - Meteorological Component (WMO/TD-No.196)*. Monitoring for the period from 1 November 2010 to 31 October 2011 was conducted for the following two tropical cyclones:

1. STS Nock-ten (1108), from 00 UTC 26 July to 23 UTC 30 July 2011
2. TY Muifa (1109), from 00 UTC 05 August to 23 UTC 09 August 2011

The results were distributed to all the Typhoon Committee Members in January 2011, and are also available on the WMO Distributed Database server at ftp://ddb.kishou.go.jp/pub/monitoring/.

Chapter 3

Summary of the 2011 Typhoon Season

In 2011, 21 TCs of tropical storm (TS) intensity or higher formed in the western North Pacific and the South China Sea. This total is less than the 30-year average* frequency of 25.6. Out ofthese 21 TCs, 8 reached typhoon (TY) intensity, 5 reached severe tropical storm (STS) intensity, and 8 reached TS intensity (Table 3.1).

Table 3.1 List of the tropical cyclones reaching TS intensity or higher in 2011

Tropical Cyclone			Duration (UTC) (TS or higher)						Minimum Central Pressure (UTC)	lat (N)	long (E)	(hPa)	Max Wind (kt)
TS	Aere	(1101)	071200	May	-	111800	May		081200	15.1	123.1	992	40
TY	Songda	(1102)	211200	May	-	290600	May		260600	15.6	125.8	920	105
TS	Sarika	(1103)	091200	Jun	-	110600	Jun		100000	18.9	117.6	996	40
TS	Haima	(1104)	211200	Jun	-	241800	Jun		240000	20.6	108.2	985	40
STS	Meari	(1105)	220000	Jun	-	270600	Jun		240900	23.6	125.0	975	60
TY	Ma-on	(1106)	120000	Jul	-	241200	Jul		161200	21.9	137.1	935	95
TS	Tokage	(1107)	150000	Jul	-	151800	Jul		150000	14.2	132.9	1000	35
STS	Nock-ten	(1108)	260000	Jul	-	310000	Jul		280600	18.1	115.5	985	50
TY	Muifa	(1109)	280600	Jul	-	090000	Aug		301800	16.6	132.4	930	95
STS	Merbok	(1110)	030600	Aug	-	091800	Aug		071800	33.1	155.5	980	50
TY	Nanmadol	(1111)	231200	Aug	-	310000	Aug		260000	16.7	123.9	925	100
STS	Talas	(1112)	250000	Aug	-	050600	Sep		291200	24.1	140.1	970	50
TS	Noru	(1113)	031200	Sep	-	061200	Sep		050600	35.1	150.0	990	40
TS	Kulap	(1114)	070000	Sep	-	090000	Sep		070600	21.6	135.7	1000	35
TY	Roke	(1115)	130600	Sep	-	220600	Sep		201200	30.3	133.6	940	85
TY	Sonca	(1116)	150600	Sep	-	201200	Sep		190000	34.6	144.3	970	70
TY	Nesat	(1117)	240000	Sep	-	301800	Sep		261800	16.2	122.9	950	80
TS	Haitang	(1118)	250000	Sep	-	261800	Sep		250000	16.4	113.1	996	35
TY	Nalgae	(1119)	271800	Sep	-	041800	Oct		010000	16.8	122.7	935	95
TS	Banyan	(1120)	101800	Oct	-	110600	Oct		101800	7.7	128.9	1002	35
STS	Washi	(1121)	150600	Dec	-	190000	Dec		160600	7.9	126.9	992	50

3.1 Atmospheric and Oceanographic Conditions in the Tropics

The La Niña event, which started in summer 2010, lasted until spring 2011. Consequently, the negative anomalies of the sea surface temperature (SST) prevailed over the tropics east of 160°E until spring 2011. Slightly negative anomaly over the area lasted until the end of the year. No specific trend was found over the South China Sea throughout the year.

From June to September, the enhanced Intertropical Convergence Zone (ITCZ) (Figure. 3.1) resulted in the formation of 16 named TCs which is the same as the 30-year average* of 16.0. From October to December, the ITCZ was weakened and fewer named TCs were generated compared to the 30-year the average* of 7.1. This contributed to the fewer than normal TC formations in the year (21 in 2011 compared to 25.6 in average*). The monthly and annual frequencies of named TCs since 1951 are presented in Appendix 4.

To see atmospheric and oceanographic conditions, the following charts are included on the attached DVD: 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 (SST anomalies 2011.ppt and Streamline 2011.ppt).

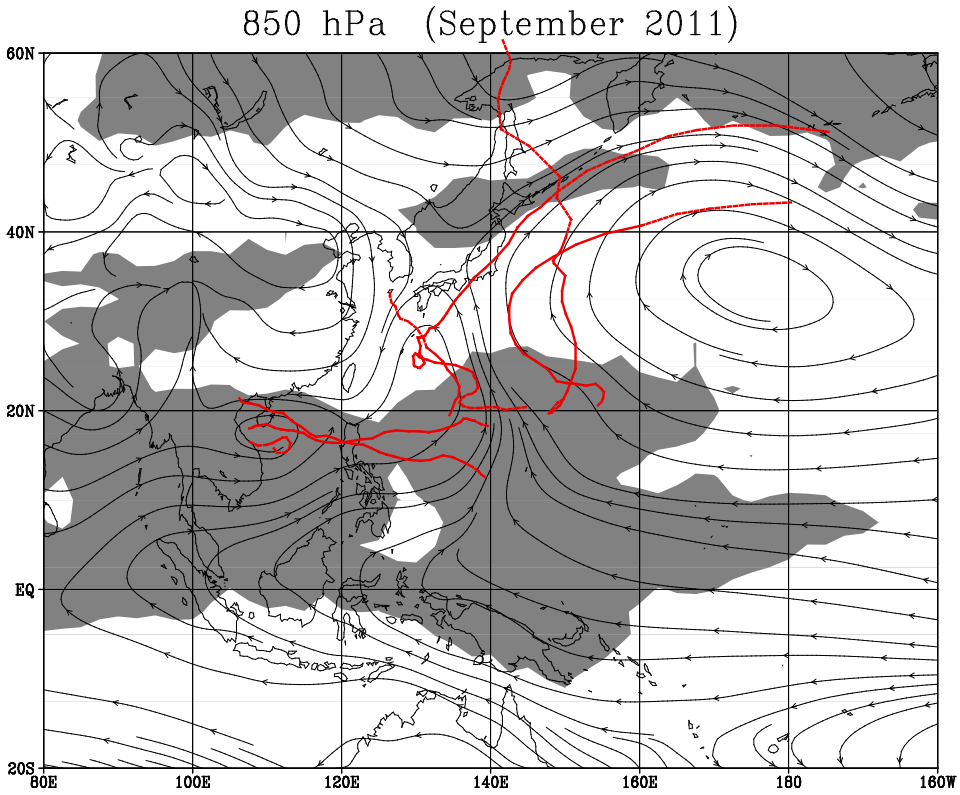


Figure 3.1 Monthly mean streamline at 850 hPa (lines with arrows) and areas of less than 230 w/m^2 of OLR (shaded) in September 2011. The tracks of the seven named TCs formed in September are superimposed onto the figure.

3.2 Tropical Cyclones in 2011

Over the western North Pacific and the South China Sea, 21 named TCs formed in 2011. Monthly and 30-year average* TC formations are shown in Figure 3.2. Tracks of the 21 TCs are shown in Figure 3.3. Figure 3.4 shows genesis points of the 21 TCs (dots) and frequency distribution of the past years (1951 - 2010).

The TC season in 2011 began with the formation of Aere (1101) in May, which formed near the Philippines. 19 named TCs formed before the end of September, which is almost the same as the 30-year average* of 18.4. From October to December, only two named TCs formed (the 30-year average* 7.1), which is the same number as in 2010 and the record-tying least number of TC formations in history since 1951. Washi (1121) formed west of Palau Islands in December and moved westward, which brought heavy damage to Mindanao Island in the Philippines. The detailed descriptions of each TC in 2011 are found in the attached DVD.

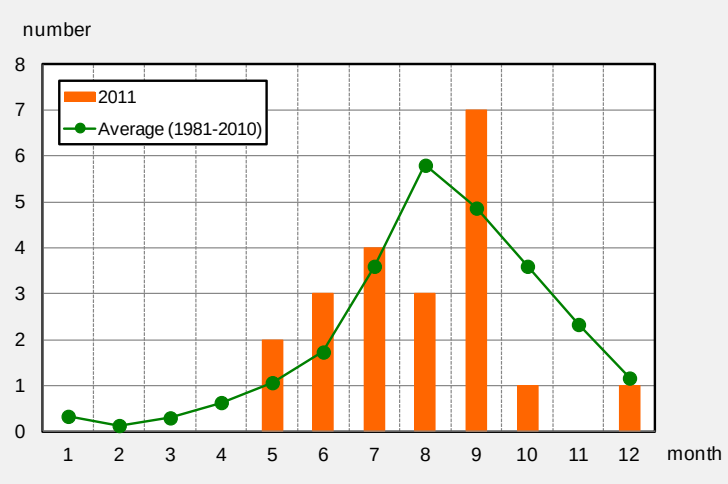


Figure 3.2 Monthly formations of TCs in 2011 compared to the 30-year average*

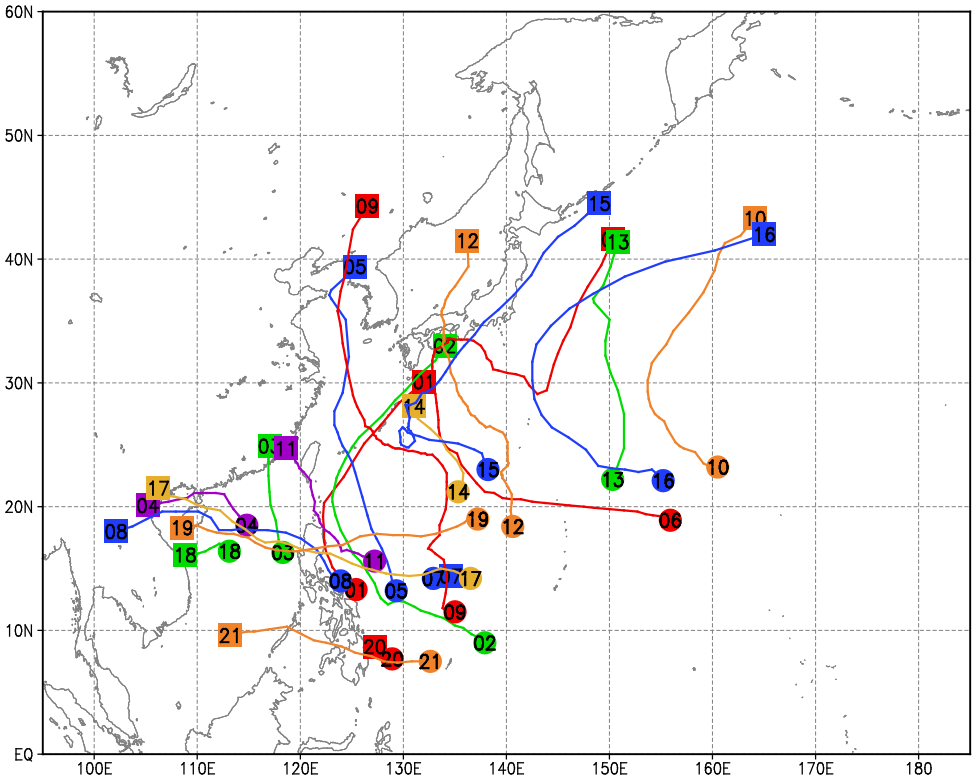


Figure 3.3 Tracks of the 21 named TCs in 2011. TC tracks for the period of TS or higher are shown.

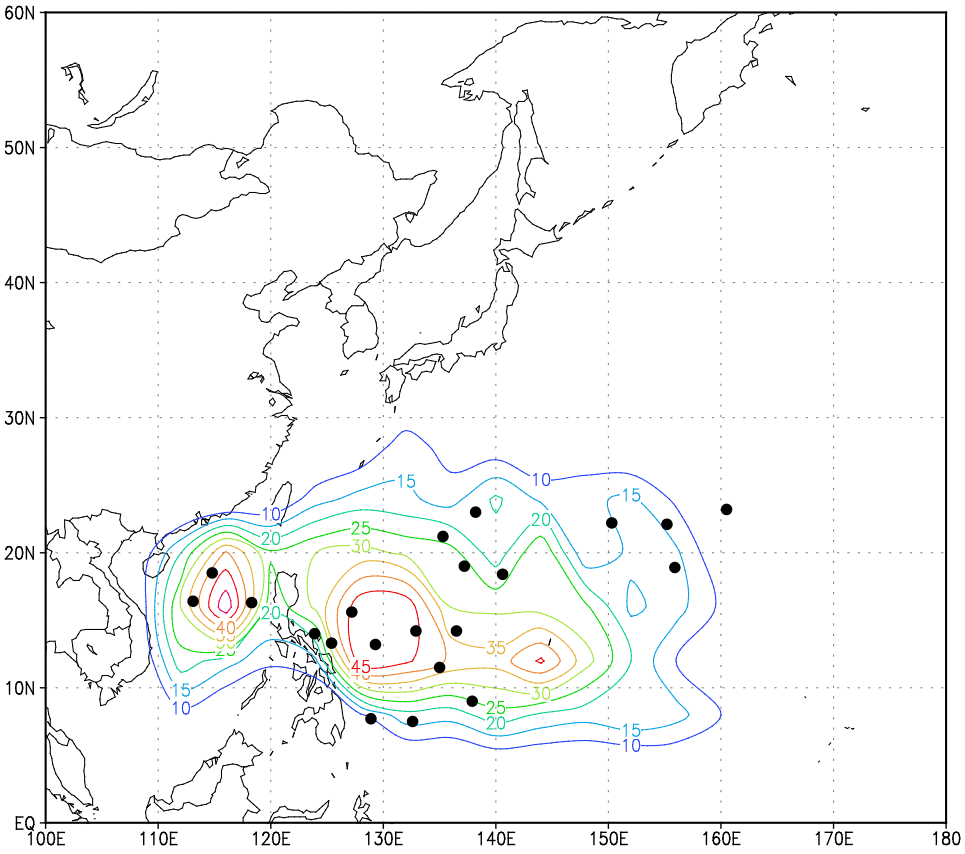


Figure 3.4 Genesis points of the 21 TCs generated in 2011 (dots) and frequency distribution of genesis points for 1951 - 2010 (lines)

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

Chapter 4

Verification of Forecasts in 2011

4.1 Verification of Operational Forecasts

Operational forecasts of the 21 TCs of TS intensity or higher in 2011 were verified with the RSMC TC best track data. The verified elements are forecasts of the center position (up to 5 days), central pressure and maximum sustained wind (up to 3 days). The position and intensity errors of operational forecasts for each TC in 2011 are indicated in Appendix 3.

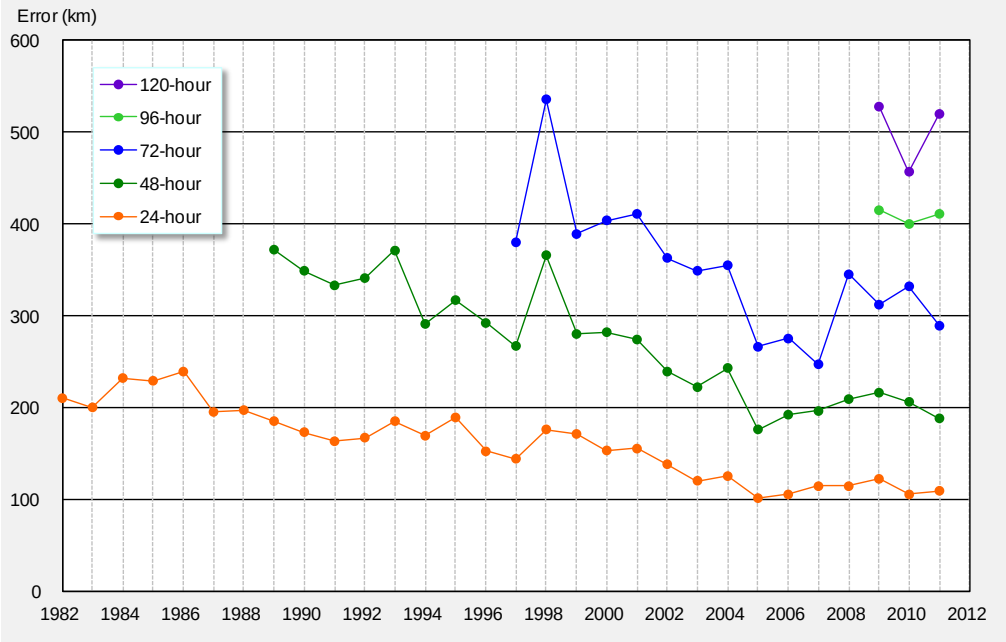


Figure 4.1 Annual mean position errors in 24-, 48-, 72-, 96- and 120-hour operational track forecasts

4.1.1 Center Position

Figure 4.1 shows annual mean errors of 24-hour (since 1982), 48-hour (since 1989), 72-hour (since 1997), 96- and 120- hour (since 2009) forecasts of center position. The errors in 2011 were 109 km, 188 km, 289 km, 411 km and 520 km for 24-hour, 48-hour, 72-hour, 96-hour and 120-hour forecasts respectively.

The details of the errors for each TC in 2011 are summarized in Table 4.1. The forecasts for Aere (1101), which was upgraded to TS intensity on a recurving track and kept the intensity four days and six hours, resulted in large forecast track errors.

The position errors were also compared with those of 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 of smaller/greater than 100% indicates that the operational forecast is better/worse than the PER method forecast. The annual mean EO/EPs for the 24-, 48-, 72-, 96- and 120-hour forecasts in 2011 were 46% (47% in 2010), 37% (40%), 36% (37%), 38%

(31%) and 39% (32%) respectively. Figure 4.2 shows a histogram of 24-hour forecast position errors. About 78% (78% in 2010) of 24-hour forecasts, 89% (77%) of 48-hour forecasts, 83% (77%) of 72-hour forecasts, 69% (78%) of 96-hour forecasts and 69% (73%) of 120-hour forecasts had errors of less than 150km, 300km, 450 km, 500km, and 600km respectively.

** The PER method is based on the assumption that a TC holds the same movement throughout the forecast period, and the linear extrapolation of the latest 12-hour track of the TC is applied to obtain the TC track forecasts. Position errors of 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 in 2011. S.D., EO, EP, and EO/EP represent the standard deviation of operational forecast position error, the operational forecast position error, the position error with the PER method, and the ratio of EO to EP respectively.

Tropical Cyclone			24-hour Forecast				48-hour Forecast				72-hour Forecast				96-hour Forecast				120-hour Forecast			
			Mean (km)	S.D. (km)	Num.	EO/EP (%)	Mean (km)	S.D. (km)	Num.	EO/EP (%)	Mean (km)	S.D. (km)	Num	EO/EP (%)	Mean (km)	S.D. (km)	Num	EO/EP (%)	Mean (km)	S.D. (km)	Num	EO/EP (%)
TS	Aere	(1101)	148	58	13	52	303	94	9	45	520	172	5	48	835	0	1	-	-	-	0	-
TY	Songda	(1102)	114	67	27	51	191	89	22	40	252	141	18	35	366	309	14	38	328	173	10	27
TS	Sarika	(1103)	181	12	3	118	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TS	Haima	(1104)	93	30	9	37	113	39	5	18	-	-	0	-	-	-	0	-	-	-	0	-
STS	Meari	(1105)	123	52	17	35	211	107	12	38	346	141	8	42	537	168	4	24	-	-	0	-
TY	Ma-on	(1106)	102	54	46	44	183	85	41	29	242	129	37	24	319	217	33	24	411	244	29	22
TS	Tokage	(1107)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
STS	Nock-ten	(1108)	133	68	16	43	222	60	12	45	317	109	8	37	431	113	4	39	-	-	0	-
TY	Muifa	(1109)	112	60	43	54	175	75	39	38	268	133	35	35	327	207	31	33	340	208	27	30
STS	Merbok	(1110)	79	35	22	39	194	78	18	40	331	159	14	40	426	234	10	36	295	147	6	16
TY	Nanmadol	(1111)	104	61	26	82	218	108	22	97	329	105	18	83	441	113	14	72	572	101	10	60
STS	Talas	(1112)	93	84	41	63	191	169	37	58	334	224	33	66	576	364	29	82	847	555	25	96
TS	Noru	(1113)	153	114	8	44	82	0	1	8	-	-	0	-	-	-	0	-	-	-	0	-
TS	Kulap	(1114)	283	33	3	68	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Roke	(1115)	131	53	32	39	197	64	27	29	320	121	23	30	513	208	19	34	845	547	15	43
TY	Sonca	(1116)	103	61	17	20	121	66	13	9	176	86	9	10	389	96	5	18	37	0	1	-
TY	Nesat	(1117)	92	75	23	54	178	78	19	68	284	99	15	78	416	134	11	71	573	176	7	56
TS	Haitang	(1118)	71	36	3	39	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Nalgae	(1119)	94	28	24	56	181	86	20	44	251	151	16	30	254	217	12	22	240	175	8	16
TS	Banyan	(1120)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
STS	Washi	(1121)	92	55	11	46	115	47	7	40	143	72	3	15	-	-	0	-	-	-	0	-
Annual Mean (Total)			109	66	384	46	188	102	304	37	289	156	242	36	411	260	187	38	520	409	138	39

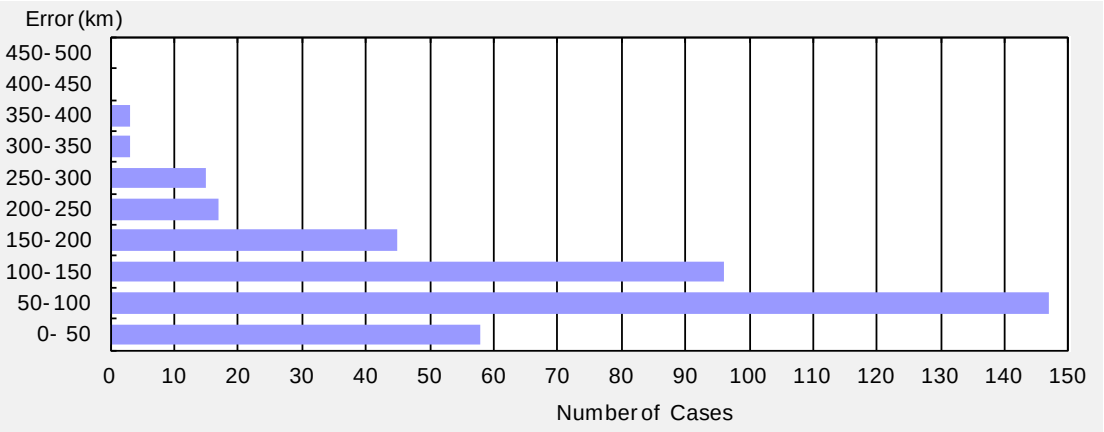


Figure 4.2 Histogram of 24-hour forecast position errors in 2011
(Those for 48-, 72-, 96- and 120-hour forecasts are included on the attached DVD).

Table 4.2 presents the mean hitting ratios and radii of the 70% probability circles* of operational forecasts for each TC in 2011. The term *hitting ratio* here is used to describe the ratio of forecasts of 70% probability circles within which the actual TC center fell. The annual mean radius of the circles issued for 24-hour position forecasts was 142 km (143 km in 2010), and their hitting ratio was 75% (76%). The corresponding ones for 48-hour forecasts were 247 km (252 km in 2010) and 75% (65%), those for 72-hour forecasts were 367 km (364 km in 2010) and 71% (61%), those for 96-hour forecasts were 508 km (498 km in 2010) and 71 % (74%) and those for 120-hour forecasts were 651 km (610 in 2010) and 75 % (77%).

Table 4.2 Mean hitting ratios (%) and radii (km) of 70% probability circles for 24-, 48-, 72-, 96- and 120-hour operational forecasts for each TC in 2011

Tropical Cyclone			24-hour Forecast			48-hour Forecast			72-hour Forecast			96-hour Forecast			120-hour Forecast		
			Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)	Ratio (%)	Num.	Radius (km)
TS	Aere	(1101)	54	13	145	44	9	259	40	5	407	0	1	444	-	0	-
TY	Songda	(1102)	67	27	139	68	22	228	78	18	318	86	14	513	100	10	597
TS	Sarika	(1103)	33	3	161	-	0	-	-	0	-	-	0	-	-	0	-
TS	Haima	(1104)	89	9	130	100	5	204	-	0	-	-	0	-	-	0	-
STS	Meari	(1105)	65	17	153	58	12	296	75	8	454	75	4	500	-	0	-
TY	Ma-on	(1106)	85	46	148	90	41	271	92	37	392	91	33	513	76	29	627
TS	Tokage	(1107)	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
STS	Nock-ten	(1108)	63	16	133	42	12	208	38	8	296	50	4	444	-	0	-
TY	Muifa	(1109)	84	43	133	72	39	220	69	35	325	77	31	471	93	27	640
STS	Merbok	(1110)	91	22	143	78	18	253	64	14	407	50	10	524	100	6	671
TY	Nanmadol	(1111)	73	26	136	64	22	254	61	18	369	86	14	546	90	10	736
STS	Talas	(1112)	78	41	145	84	37	266	70	33	419	52	29	558	44	25	700
TS	Noru	(1113)	75	8	182	100	1	333	-	0	-	-	0	-	-	0	-
TS	Kulap	(1114)	0	3	130	-	0	-	-	0	-	-	0	-	-	0	-
TY	Roke	(1115)	56	32	151	67	27	247	52	23	349	42	19	454	40	15	544
TY	Sonca	(1116)	82	17	147	100	13	299	100	9	447	100	5	570	100	1	695
TY	Nesat	(1117)	78	23	134	74	19	204	67	15	296	73	11	529	86	7	794
TS	Haitang	(1118)	100	3	130	-	0	-	-	0	-	-	0	-	-	0	-
TY	Nalgae	(1119)	88	24	133	70	20	223	69	16	337	75	12	475	100	8	642
TS	Banyan	(1120)	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
STS	Washi	(1121)	73	11	139	100	7	259	100	3	389	-	0	-	-	0	-
Annual Mean (Total)			75	384	142	75	304	247	71	242	367	71	187	508	75	138	651

* 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 in 2011. The RMSEs for maximum wind speed forecasts are included on the attached DVD. The annual mean RMSEs of the central pressure and the maximum wind speed for 24-hour forecasts were 11.7 hPa (12.2 hPa in 2010) and 5.6 m/s (5.1 m/s). For 48-hour forecasts, the corresponding ones were 17.8 hPa (17.4 hPa in 2010) and 8.6 m/s (5.3 m/s), while those for 72-hour forecasts were 19.2 hPa (22.6 hPa in 2010) and 9.1 m/s (7.2 m/s) respectively.

Table 4.3 Mean intensity errors of 24-, 48- and 72-hour operational central pressure forecasts for each TC in 2011

Tropical Cyclone			24-hour Forecast			48-hour Forecast			72-hour Forecast		
			Error (hPa)	RMSE (hPa)	Num.	Error (hPa)	RMSE (hPa)	Num.	Error (hPa)	RMSE (hPa)	Num.
TS	Aere	(1101)	-1.9	3.7	13	-1.6	6.1	9	-4.0	8.0	5
TY	Songda	(1102)	0.9	12.6	27	-0.2	15.9	22	2.2	12.5	18
TS	Sarika	(1103)	-4.0	5.2	3	-	-	0	-	-	0
TS	Haima	(1104)	7.6	8.4	9	12.0	12.2	5	-	-	0
STS	Meari	(1105)	1.7	5.7	17	-4.7	8.1	12	-6.2	8.3	8
TY	Ma-on	(1106)	-10.5	14.4	46	-15.9	19.5	41	-17.2	19.7	37
TS	Tokage	(1107)	-	-	0	-	-	0	-	-	0
STS	Nock-ten	(1108)	-0.1	3.7	16	-6.3	8.2	12	-9.5	11.5	8
TY	Muifa	(1109)	0.1	13.6	43	-1.4	17.4	39	-1.1	14.6	35
STS	Merbok	(1110)	-2.2	6.6	22	-2.8	5.0	18	-2.5	4.0	14
TY	Nanmadol	(1111)	-2.8	21.7	26	-7.6	34.7	22	-21.8	38.2	18
STS	Talas	(1112)	-6.2	7.6	41	-11.5	13.5	37	-12.9	15.5	33
TS	Noru	(1113)	3.0	3.9	8	0.0	0.0	1	-	-	0
TS	Kulap	(1114)	-4.7	4.8	3	-	-	0	-	-	0
TY	Roke	(1115)	5.3	9.5	32	8.0	11.7	27	10.7	14.8	23
TY	Sonca	(1116)	10.3	11.7	17	18.9	19.7	13	23.6	24.1	9
TY	Nesat	(1117)	-2.6	7.7	23	-1.3	13.2	19	-8.0	13.0	15
TS	Haitang	(1118)	-5.3	5.4	3	-	-	0	-	-	0
TY	Nalgae	(1119)	-1.8	15.9	24	-4.2	27.4	20	-11.1	30.9	16
TS	Banyan	(1120)	-	-	0	-	-	0	-	-	0
STS	Washi	(1121)	-1.3	4.0	11	-0.3	2.7	7	-2.7	2.8	3
Annual Mean (Total)			-1.4	11.7	384	-3.6	17.8	304	-6.1	19.2	242

Figure 4.3 shows a histogram of maximum wind speed errors for 24-hour forecasts. About 57% (53% in 2010) of 24-hour forecasts had errors of less than ±3.75 m/s, with figures of ±6.25 m/s for 55% (71%) of 48-hour forecasts and ±6.25 m/s for 56% (61%) of 72-hour forecasts.

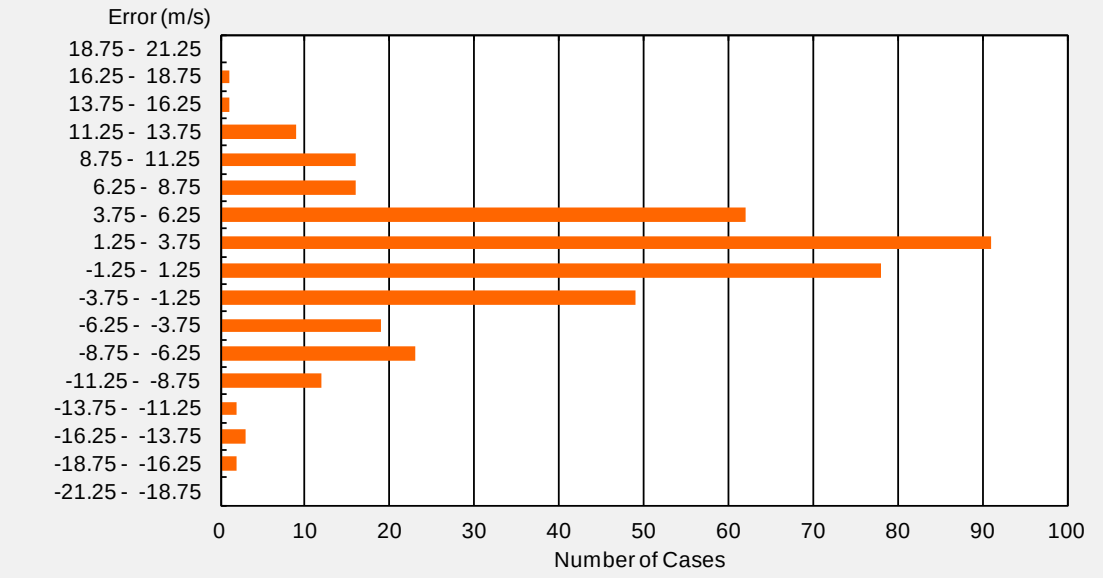


Figure 4.3 Histogram of 24-hour forecast maximum wind speed errors in 2011
(Those for 48-, 72-, 96- and 120-hour forecasts are included on the attached DVD).

4.2 Verification of Numerical Models (GSM, TEPS)

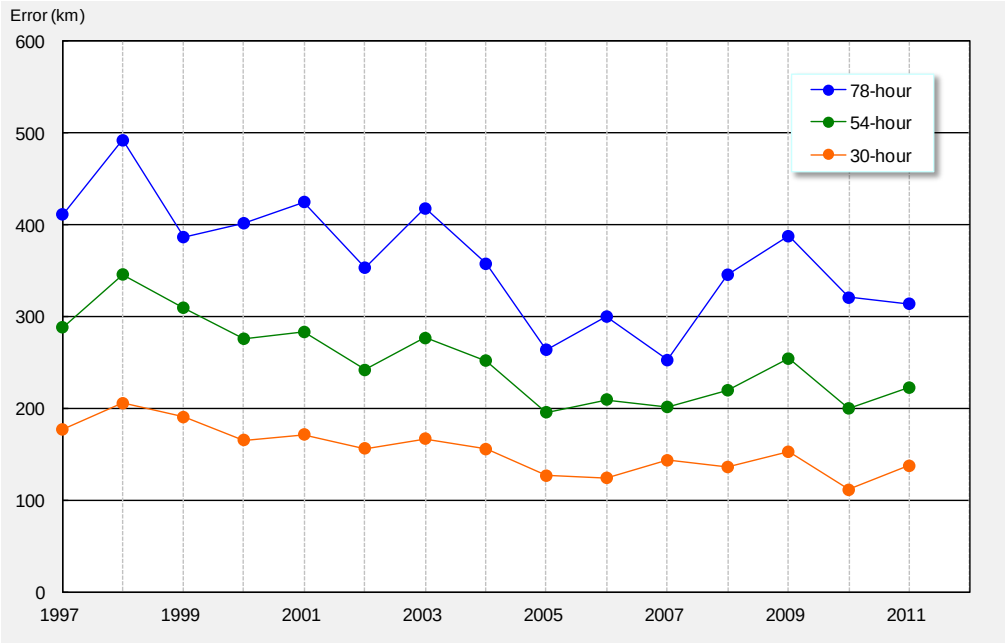


Figure 4.4 GSM annual mean position errors since 1997

The Global Spectral Model (GSM) and the Typhoon Ensemble Prediction System (TEPS) provide primary information for JMA forecasters to make operational TC track and intensity forecasts.

The details and recent improvements on GSM and TEPS 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 the both systems.

4.2.1 GSM Predictions

1) Center Position

The GSM annual mean position errors since 1997 are presented in Figure 4.4. In 2011, the annual mean errors for 30-, 54- and 78-hour* predictions were 137 km (111 km in 2010), 223 km (200 km) and 314 km (321 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- 78-hour predictions using GSM are the primary information for forecasters preparing 24-, 48- and 72-hour operational forecasts respectively.*

Table 4.4 Mean position errors (km) of GSM for each TC in 2011.
The number of samples is given in parentheses.

Tropical Cyclone			T=18		T=30		T=42		T=54		T=66		T=78	
TS	Aere	(1101)	98.2	(18)	165.1	(16)	209.9	(14)	270.9	(12)	310.6	(9)	338.6	(6)
TY	Songda	(1102)	77.1	(32)	117.5	(30)	152.6	(28)	186.5	(26)	212.9	(24)	247.9	(22)
TS	Sarika	(1103)	93.5	(5)	118.1	(3)	-	(-)	-	(-)	-	(-)	-	(-)
TS	Haima	(1104)	90.0	(28)	148.2	(26)	195.5	(24)	267.9	(18)	352.0	(12)	464.7	(6)
STS	Meari	(1105)	113.5	(20)	100.3	(18)	112.3	(16)	196.8	(14)	274.4	(12)	345.3	(10)
TY	Ma-on	(1106)	80.5	(48)	113.8	(46)	149.5	(44)	185.4	(42)	215.4	(40)	217.3	(38)
TS	Tokage	(1107)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
STS	Nock-ten	(1108)	92.3	(22)	134.2	(20)	169.9	(17)	235.8	(15)	286.7	(13)	373.4	(11)
TY	Muifa	(1109)	114.7	(50)	154.6	(48)	184.0	(46)	213.5	(44)	251.0	(42)	302.2	(40)
STS	Merbok	(1110)	87.4	(24)	110.1	(22)	152.9	(20)	205.0	(18)	264.3	(16)	349.9	(14)
TY	Nanmadol	(1111)	111.7	(33)	169.2	(31)	212.1	(28)	271.5	(26)	353.3	(23)	470.5	(20)
STS	Talas	(1112)	63.0	(47)	86.4	(45)	134.9	(43)	183.2	(41)	243.7	(39)	311.9	(37)
TS	Noru	(1113)	135.7	(14)	146.8	(11)	192.2	(8)	180.0	(6)	179.6	(4)	176.1	(3)
TS	Kulap	(1114)	85.1	(9)	132.0	(7)	191.7	(5)	200.2	(3)	80.2	(1)	-	(-)
TY	Roke	(1115)	153.6	(46)	224.5	(43)	296.9	(41)	334.7	(39)	361.9	(36)	404.9	(34)
TY	Sonca	(1116)	85.4	(20)	108.4	(18)	124.9	(16)	126.1	(14)	128.0	(12)	176.3	(10)
TY	Nesat	(1117)	73.1	(26)	90.2	(23)	118.4	(21)	159.9	(20)	225.2	(18)	298.3	(16)
TS	Haitang	(1118)	61.6	(9)	53.9	(7)	48.5	(5)	99.1	(3)	130.7	(1)	-	(-)
TY	Nalgae	(1119)	64.5	(30)	84.3	(28)	109.8	(26)	137.8	(24)	188.0	(22)	192.9	(20)
TS	Banyan	(1120)	240.9	(13)	348.8	(10)	456.1	(10)	565.3	(9)	590.8	(8)	601.4	(5)
STS	Washi	(1121)	144.5	(15)	173.9	(13)	208.9	(11)	239.7	(9)	268.4	(7)	305.4	(5)
Annual Mean (Total)			100.2	(509)	137.2	(465)	178.6	(423)	222.5	(383)	266.8	(339)	314.0	(297)

Table 4.5 gives GSM's relative performance compared with the PER method. In this comparison, life stages of TCs were classified into the three stages of before, during and after recurvature. Each stage is defined with the direction of movement of each TC at each prediction time. The table indicates that GSM outperformed the PER method throughout the forecast period beyond 18 hours from the initial time, and that the rates of error reduction for GSM compared to the PER method were about 42% (51% in 2010), 52% (64%), 61% (67%) and 64% (68%) for 18-, 30-, 54- and 78-hour predictions respectively.

About 71% (76% in 2010) of 30-hour predictions had errors of less than 150 km, while 79% (81%) of 54-hour predictions had errors of less than 300 km, and 80% (80%) of 78-hour predictions had errors of less than 450 km respectively. Histograms of the position errors of 30-, 54- and 78-hour predictions are included on the attached DVD.

Table 4.5 Mean position errors (km) of GSM and PER method predictions for the 21 TCs in 2011 in the stages before, during and after recurvature. The number of samples is given in parentheses. IMPROV is error reduction rate of GSM to the PER method.

TIME	MODEL	Before	During	After	All
T=18	GSM	97.6 (255)	94.8 (156)	115.5 (98)	100.2 (509)
	PER	145.5 (255)	172.3 (156)	240.4 (98)	172.0 (509)
	IMPROV	32.9 %	45.0 %	52.0 %	41.8 %
T=30	GSM	132.9 (229)	126.8 (140)	162.5 (96)	137.2 (465)
	PER	240.0 (229)	284.5 (140)	408.0 (96)	288.1 (465)
	IMPROV	44.6 %	55.4 %	60.2 %	52.4 %
T=42	GSM	173.1 (199)	169.4 (130)	202.8 (94)	178.6 (423)
	PER	348.9 (199)	415.4 (130)	586.6 (94)	422.2 (423)
	IMPROV	50.4 %	59.2 %	65.4 %	57.7 %
T=54	GSM	213.9 (174)	216.4 (117)	246.4 (92)	222.5 (383)
	PER	446.2 (174)	544.3 (117)	814.8 (92)	564.7 (383)
	IMPROV	52.1 %	60.2 %	69.8 %	60.6 %
T=66	GSM	266.8 (147)	262.5 (106)	272.2 (86)	266.8 (339)
	PER	541.1 (147)	643.1 (106)	1069.1 (86)	707.0 (339)
	IMPROV	50.7 %	59.2 %	74.5 %	62.3 %
T=78	GSM	308.9 (120)	324.2 (92)	310.1 (85)	314.0 (297)
	PER	633.2 (120)	774.7 (92)	1284.8 (85)	863.5 (297)
	IMPROV	51.2 %	58.2 %	75.9 %	63.6 %

2) Central Pressure and Maximum Wind Speed

The mean errors of 30-, 54-, 78-hour central pressure predictions by GSM in 2011 were +4.4 hPa (+12.1 hPa in 2010), +3.0 hPa (+12.7 hPa) and +1.5 hPa (+12.8 hPa) respectively. Their root mean square errors (RMSEs) were 16.1 hPa (20.9 hPa in 2010) for 30-hour predictions, 19.7 hPa (21.9 hPa) for 54-hour predictions and 23.9 hPa (27.4 hPa) for 78-hour predictions. The bias for 30-, 54-, and 78-hour maximum wind speed predictions were -5.4 m/s (-7.5 m/s in 2010) with RMSE of 9.2 m/s (10.3 m/s), -4.2 m/s (-7.8 m/s) with RMSE of 10.5 m/s (11.1 m/s) and -3.3 m/s (-7.1 m/s) with RMSE of 11.9 m/s (13.3 m/s) respectively.

Figure 4.5 shows histograms of the central pressure errors and the maximum wind speed errors of 30-hour GSM predictions. The figures show that GSM tends to underestimate the wind speed of TCs (right) and has a small positive bias for the central pressure prediction (left). This underestimate results from the fact that the current horizontal resolution of GSM (about 20 km) is not fine enough to produce the TC core structure especially when it is intense and small.

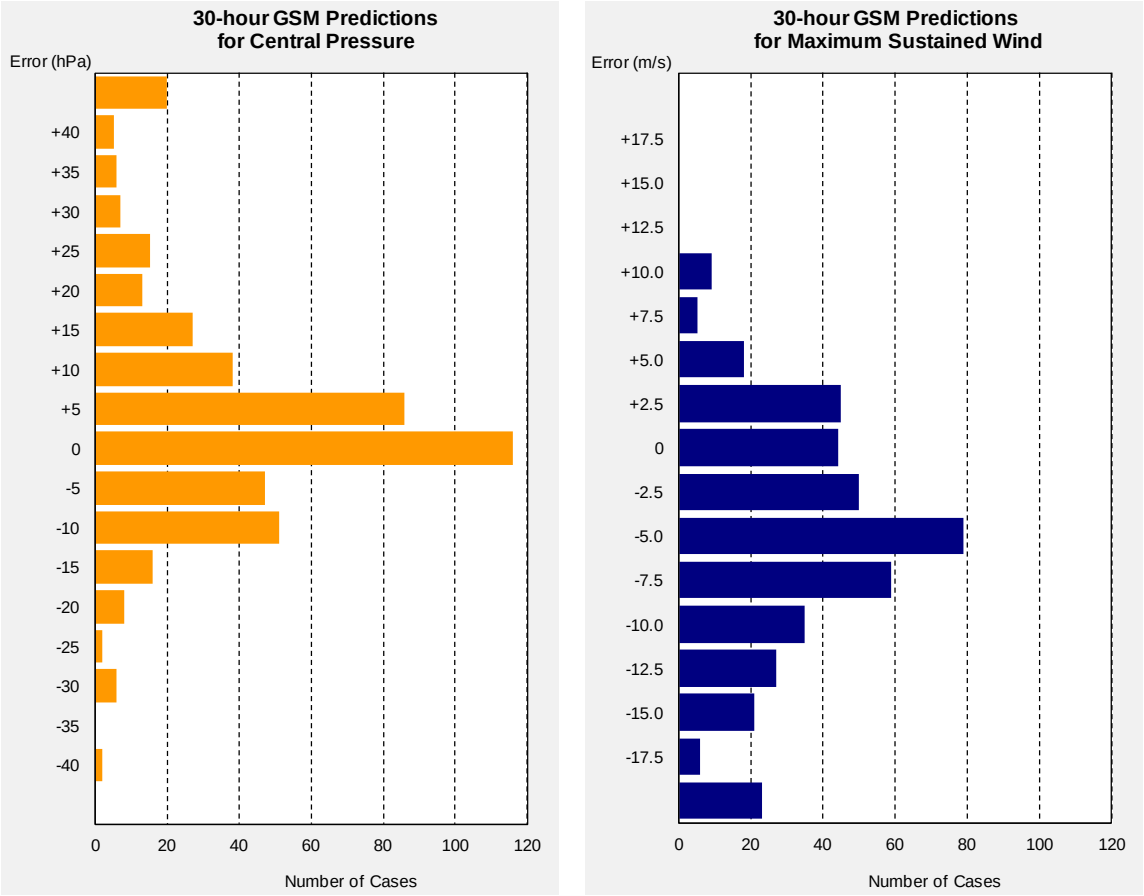


Figure 4.5 Error distributions of GSM 30-hour intensity predictions in 2011.
The figure on the left shows error distributions for central pressure, while the one on the right shows those for maximum wind speed (the error distributions of 54- and 78-hour predictions are included on the attached DVD).

4.2.2 TEPS Predictions

1) Ensemble mean center position

The mean position error of TEPS ensemble mean forecasts at 30-, 54-, 78-, 102- and 126-hour predictions for each TC are given in Table 4.6. Annual means of ensemble mean position error at 30-, 54-, 78-, 102- and 126-hour predictions are 148 km (137 km in GSM), 248 km (223 km), 353 km (314 km), 474 km and 584 km, respectively.

Table 4.6 Mean position errors (km) of TEPS ensemble mean forecasts for each TC in 2011. The number of samples is given in parentheses.

Tropical Cyclone			T=30		T=54		T=78		T=102		T=126	
TS	Aere	(1101)	191.6	(15)	262.0	(9)	321.0	(4)	649.3	(2)	-	(-)
TY	Songda	(1102)	126.7	(30)	198.7	(26)	265.5	(22)	384.4	(18)	337.1	(14)
TS	Sarika	(1103)	228.2	(1)	-	(-)	-	(-)	-	(-)	-	(-)
TS	Haima	(1104)	159.7	(23)	419.8	(9)	691.2	(2)	-	(-)	-	(-)
STS	Meari	(1105)	113.9	(18)	207.3	(14)	392.0	(10)	600.2	(6)	809.8	(2)
TY	Ma-on	(1106)	125.6	(46)	220.3	(42)	296.1	(38)	367.9	(34)	422.1	(30)
TS	Tokage	(1107)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
STS	Nock-ten	(1108)	148.6	(20)	280.0	(16)	416.4	(12)	586.4	(8)	819.3	(3)
TY	Muifa	(1109)	164.0	(48)	223.9	(44)	312.1	(40)	401.4	(36)	455.4	(32)
STS	Merbok	(1110)	123.0	(21)	264.1	(17)	447.2	(13)	649.5	(9)	498.9	(5)
TY	Nanmadol	(1111)	152.9	(27)	278.7	(23)	390.5	(19)	515.4	(15)	640.3	(11)
STS	Talas	(1112)	94.7	(45)	188.5	(41)	338.6	(37)	614.9	(33)	987.8	(29)
TS	Noru	(1113)	196.9	(11)	213.9	(7)	240.3	(3)	-	(-)	-	(-)
TS	Kulap	(1114)	126.1	(7)	239.6	(3)	-	(-)	-	(-)	-	(-)
TY	Roke	(1115)	231.9	(44)	375.6	(40)	488.6	(36)	534.8	(29)	668.0	(23)
TY	Sonca	(1116)	108.6	(18)	130.8	(14)	190.8	(9)	452.8	(4)	-	(-)
TY	Nesat	(1117)	124.3	(24)	225.9	(21)	353.1	(17)	473.0	(13)	617.4	(9)
TS	Haitang	(1118)	60.1	(7)	104.1	(3)	-	(-)	-	(-)	-	(-)
TY	Nalgae	(1119)	88.0	(28)	165.5	(24)	248.6	(20)	299.2	(16)	342.5	(12)
TS	Banyan	(1120)	371.4	(11)	545.2	(10)	626.6	(6)	494.5	(2)	-	(-)
STS	Washi	(1121)	177.6	(14)	275.2	(8)	365.6	(2)	-	(-)	-	(-)
Annual Mean (Total)			148.2	(458)	248.4	(371)	353.2	(290)	473.7	(225)	583.8	(170)

2) Spread-skill relationship

While position error of TEPS ensemble mean forecast was larger than GSM in short range forecast, TEPS gives the useful information on the reliability of the TC track forecast with its ensemble spread. Figure 4.6 shows relationship between 6-hourly accumulated ensemble spread on the TC position forecast and ensemble mean forecast position error at 126-hour prediction. In an ideal EPS with a large number of samples, large position error is found when the ensemble spread is large.

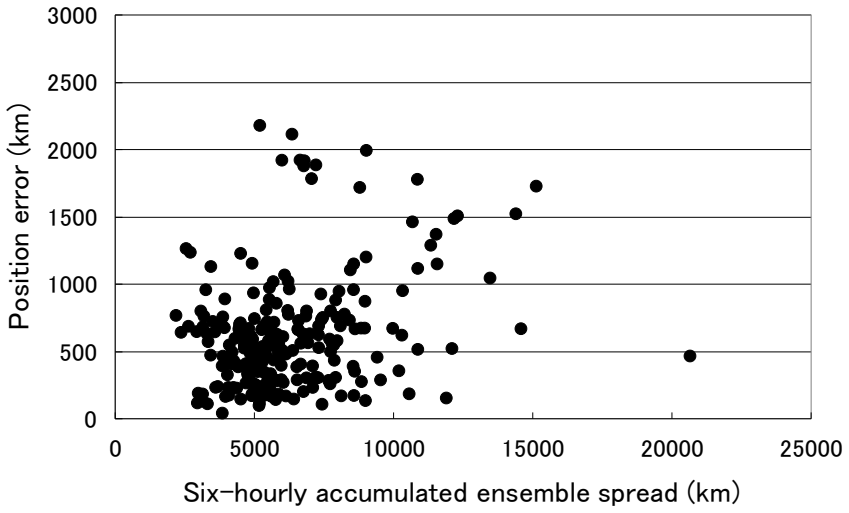


Figure 4.6 Relation between 6-hourly accumulated ensemble spread on the TC position forecast (km) and ensemble mean forecast position error (km) at 126-hour prediction in 2011.

To add reliability information to TC track forecast, we have introduced a reliability index in which the categories A, B and C represent the highest, middle-level and lowest reliability, respectively. The index is determined by 6-hourly accumulated ensemble spread at each forecast time. The levels of the categories were set with the results from the pre-operational runs of TEPS so that the frequency of each category becomes 40%, 40% and 20%, respectively. Table 4.7 shows ensemble mean forecast errors classified with the reliability index. Theoretically, mean position errors of reliability A should be smaller than those of the reliability B and C throughout the forecast times with a sufficient number of samples in an ideal EPS. The result shows that TEPS can give the appropriate reliability information on the typhoon forecast in 2011.

Table 4.7 Ensemble mean forecast position errors (km) in 2011 classified with 6-hourly accumulated ensemble spread at each forecast time. The number of samples is given in parentheses.

	Reliabilty Index					
Time	A		B		C	
T=30	113.2	(150)	133.5	(256)	236.4	(97)
T=54	182.5	(141)	245.3	(208)	362.6	(83)
T=78	281.6	(123)	343.8	(179)	552.1	(55)
T=102	390.3	(104)	468.0	(146)	702.6	(44)
T=126	530.1	(79)	601.2	(118)	888.8	(39)

Appendices

RSMC Tropical Cyclone Best Track Data in 2011

Appendix 1

Aere (1101)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
May 06/12	11.9	128.2	1004	-	0.5	TD
06/18	12.0	127.4	1000	-	1.0	TD
07/00	12.5	126.7	1000	-	1.0	TD
07/06	12.9	126.0	998	-	1.5	TD
07/12	13.3	125.4	996	35	2.0	TS
07/18	13.5	124.7	996	35	2.0	TS
08/00	14.0	124.2	996	35	2.0	TS
08/06	14.5	123.7	994	35	2.0	TS
08/12	15.1	123.1	992	40	2.5	TS
08/18	15.6	122.9	992	40	2.5	TS
09/00	16.3	122.5	992	40	2.5	TS
09/06	17.2	122.3	996	35	2.0	TS
09/12	18.0	122.3	996	35	2.0	TS
09/18	19.2	122.2	996	35	1.5	TS
10/00	20.3	122.3	996	35	2.0	TS
10/06	21.2	123.1	996	35	2.0	TS
10/12	22.4	124.2	996	35	2.0	TS
10/18	23.5	125.0	996	35	2.0	TS
11/00	25.1	126.2	996	35	2.0	TS
11/06	26.6	127.8	996	35	2.0	TS
11/12	28.4	129.6	996	35	2.0	TS
11/18	30.1	132.0	998	-	1.5	TD
12/00	31.2	134.4	998	-	1.5	TD
12/06	32.7	137.2	996	-	1.0	TD
12/12	34.5	140.7	996	-	-	TD
12/18	36.4	143.3	990	-	-	L
13/00	37.9	145.8	988	-	-	L
13/06	39.2	148.1	986	-	-	L
13/12	41.1	150.7	986	-	-	L
13/18	43.2	154.3	984	-	-	L
14/00	45.0	157.7	984	-	-	L
14/06	46.6	161.3	980	-	-	L
14/12	48.1	165.1	980	-	-	L
14/18	49.6	169.2	978	-	-	L
15/00	51.3	174.5	978	-	-	L
15/06	52.6	180.5	978	-	-	Out

Songda (1102)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
May 19/18	8.3	141.6	1006	-	1.0	TD
20/00	8.3	141.3	1006	-	1.0	TD
20/06	8.2	140.9	1004	-	1.0	TD
20/12	8.3	140.2	1004	-	1.5	TD
20/18	8.4	139.5	1004	-	1.5	TD
21/00	8.7	138.6	1004	-	1.5	TD
21/06	8.8	138.3	1002	-	2.0	TD
21/12	9.0	137.9	1000	35	2.5	TS
21/18	9.2	137.5	998	35	2.5	TS
22/00	9.5	137.1	994	40	3.0	TS
22/06	9.7	136.6	990	45	3.0	TS
22/12	10.2	135.8	985	50	3.5	STS
22/18	10.4	135.0	985	50	3.5	STS
23/00	11.0	133.9	985	50	3.5	STS
23/06	11.2	133.1	985	50	3.5	STS
23/12	11.4	132.5	985	55	3.5	STS
23/18	11.6	131.7	980	55	3.5	STS
24/00	11.9	131.1	980	55	4.0	STS
24/06	12.3	130.1	975	60	4.0	STS
24/12	12.4	129.3	975	60	4.0	STS
24/18	12.1	128.5	970	65	4.5	TY
25/00	12.3	128.2	965	70	4.5	TY
25/06	12.6	127.8	955	75	5.0	TY
25/12	13.1	127.5	945	85	5.5	TY
25/18	13.8	127.2	935	95	6.0	TY
26/00	14.7	126.5	930	100	7.0	TY
26/06	15.6	125.8	920	105	7.0	TY
26/12	16.2	125.1	920	105	7.0	TY
26/18	17.2	124.5	920	105	7.0	TY
27/00	18.1	123.9	920	105	7.0	TY
27/06	19.3	123.4	930	100	6.5	TY
27/12	20.4	123.1	930	95	6.0	TY
27/15	20.8	123.1	935	95	-	TY
27/18	21.5	123.3	940	90	5.0	TY
27/21	22.3	123.5	940	90	-	TY
28/00	22.9	123.8	940	90	5.0	TY
28/03	23.9	124.4	940	90	-	TY
28/06	24.8	125.0	940	90	4.5	TY
28/09	25.6	125.7	945	80	-	TY
28/12	26.3	126.6	950	80	4.5	TY
28/15	27.4	128.0	960	75	-	TY
28/18	28.6	129.2	965	70	4.0	TY
28/21	29.4	130.2	970	65	-	TY
29/00	30.7	131.6	975	60	3.5	STS
29/03	31.8	133.1	980	55	-	STS
29/06	33.0	134.0	982	-	3.0	L
29/12	34.2	136.6	988	-	-	L
29/18	34.5	137.4	988	-	-	L
30/00	34.6	139.6	990	-	-	L
30/06	35.8	142.8	990	-	-	L
30/12	36.5	145.2	990	-	-	L
30/18	36.4	148.1	990	-	-	L
31/00	36.3	150.9	988	-	-	L
31/06	36.7	154.6	988	-	-	L
31/12	37.3	156.8	988	-	-	L
31/18	37.7	158.6	988	-	-	L
Jun. 01/00	37.8	160.5	988	-	-	L
01/06	38.8	165.4	988	-	-	L
01/12	39.4	169.7	988	-	-	L
01/18	40.5	173.6	988	-	-	L
02/00	42.0	178.2	990	-	-	L
02/06						Dissip.

Sarika (1103)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun. 08/18	14.3	120.3	1004	-	1.0	TD
09/00	14.7	119.7	1006	-	1.0	TD
09/06	15.3	119.1	1004	-	1.0	TD
09/12	16.3	118.3	1000	35	1.5	TS
09/18	17.3	117.9	998	40	2.0	TS
10/00	18.9	117.6	996	40	2.0	TS
10/06	20.1	117.1	996	40	2.0	TS
10/12	21.2	117.0	998	35	2.0	TS
10/18	22.5	116.9	998	35	2.0	TS
11/00	23.8	116.9	1000	35	2.0	TS
11/06	24.9	117.0	1002	-	1.5	TD
11/12						Dissip.

Haima (1104)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun. 16/18	9.3	129.1	1008	-	1.0	TD
17/00	10.0	129.1	1008	-	0.5	TD
17/06	10.7	128.5	1006	-	0.5	TD
17/12	11.7	127.8	1008	-	1.0	TD
17/18	12.4	127.4	1006	-	1.0	TD
18/00	13.4	126.7	1006	-	1.0	TD
18/06	14.4	125.6	1004	-	1.0	TD
18/12	15.2	124.9	1004	-	1.5	TD
18/18	15.9	124.5	1002	-	1.5	TD
19/00	16.7	124.2	1002	-	1.5	TD
19/06	17.6	123.7	1002	-	1.5	TD
19/12	18.7	122.6	1004	-	1.5	TD
19/18	19.3	121.0	1002	-	1.5	TD
20/00	19.9	119.7	1002	-	1.5	TD
20/06	19.5	118.7	1000	-	1.0	TD
20/12	19.1	117.5	1000	-	1.0	TD
20/18	18.9	116.6	998	-	1.0	TD
21/00	18.8	116.1	998	-	1.5	TD
21/06	18.6	115.5	996	-	2.0	TD
21/12	18.5	114.8	994	35	2.0	TS
21/18	18.8	114.4	994	35	2.0	TS
22/00	19.3	114.0	994	35	2.0	TS
22/06	19.8	113.5	992	35	2.0	TS
22/12	20.3	113.1	990	40	2.5	TS
22/18	21.0	112.6	990	40	2.5	TS
23/00	21.1	111.8	990	40	2.5	TS
23/06	21.1	110.9	990	40	2.5	TS
23/12	21.1	109.7	990	35	2.5	TS
23/18	20.7	109.0	990	35	2.5	TS
24/00	20.6	108.2	985	40	2.5	TS
24/06	20.4	107.2	985	40	2.5	TS
24/12	20.3	106.4	990	35	2.5	TS
24/18	20.1	105.2	990	-	2.5	TD
25/00	19.8	104.3	992	-	2.0	TD
25/06	19.6	103.9	996	-	-	TD
25/12	19.1	103.3	996	-	-	TD
25/18						Dissip.

Meari (1105)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jun. 20/18	11.0	133.4	1002	-	0.0	TD
21/00	11.4	132.4	1002	-	0.0	TD
21/06	11.8	131.4	1002	-	0.5	TD
21/12	12.0	130.5	1000	-	1.0	TD
21/18	12.5	129.7	1000	-	1.5	TD
22/00	13.2	129.3	998	35	1.5	TS
22/06	14.0	128.9	998	35	1.5	TS
22/12	14.8	128.7	994	40	2.0	TS
22/18	15.6	128.4	990	45	2.5	TS
23/00	16.6	127.9	985	50	2.5	STS
23/06	17.4	127.4	985	50	2.5	STS
23/12	18.2	126.9	985	50	2.5	STS
23/18	19.3	126.5	985	50	2.5	STS
24/00	20.8	126.0	980	55	3.0	STS
24/06	22.8	125.3	980	55	3.0	STS
24/09	23.6	125.0	975	60	-	STS
24/12	24.4	124.5	975	60	3.0	STS
24/15	24.9	124.1	975	60	-	STS
24/18	25.5	123.8	975	60	3.0	STS
24/21	26.0	123.6	975	60	-	STS
25/00	26.6	123.3	975	60	3.0	STS
25/06	27.7	123.3	975	60	3.0	STS
25/12	29.2	124.1	980	55	3.0	STS
25/18	32.1	124.7	980	55	2.5	STS
26/00	35.1	124.4	980	55	2.5	STS
26/06	36.8	123.0	980	55	2.5	STS
26/12	37.1	122.8	980	55	2.5	STS
26/18	37.5	123.0	985	50	2.0	STS
27/00	38.5	124.3	990	45	2.0	TS
27/06	39.4	125.3	996	-	1.5	L
27/12						Dissip.

Ma-on (1106)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul.	11/12	18.5	157.3	1006	-	1.0	TD
	11/18	18.7	156.6	1004	-	1.0	TD
	12/00	18.9	155.9	1000	35	1.5	TS
	12/06	19.2	155.2	1000	35	2.0	TS
	12/12	19.3	154.2	996	40	2.5	TS
	12/18	19.4	153.5	990	45	2.5	TS
	13/00	19.6	152.7	985	50	3.0	STS
	13/06	19.7	151.4	985	50	3.0	STS
	13/12	19.8	150.0	980	55	3.5	STS
	13/18	19.9	148.5	970	60	3.5	STS
	14/00	20.0	147.5	965	65	4.0	TY
	14/06	20.1	146.1	965	65	4.0	TY
	14/12	20.2	144.9	960	75	4.5	TY
	14/18	20.3	143.7	960	75	4.5	TY
	15/00	20.4	142.5	955	80	5.0	TY
	15/06	20.6	141.4	955	80	5.0	TY
	15/12	20.6	140.5	950	85	5.5	TY
	15/18	20.7	139.6	950	85	5.5	TY
	16/00	21.1	138.8	950	85	5.5	TY
	16/06	21.2	137.9	940	95	6.0	TY
	16/12	21.9	137.1	935	95	6.0	TY
	16/18	22.7	136.3	935	95	6.0	TY
	17/00	23.4	135.6	935	95	6.0	TY
	17/03	24.3	135.2	935	95	-	TY
	17/06	24.6	134.5	940	85	5.5	TY
	17/09	24.8	134.2	940	85	-	TY
	17/12	25.2	133.9	940	85	5.5	TY
	17/15	25.5	133.6	940	85	-	TY
	17/18	25.9	133.5	950	80	5.0	TY
	17/21	26.4	133.4	950	80	-	TY
	18/00	27.0	133.4	950	80	5.0	TY
	18/03	27.7	133.3	950	80	-	TY
	18/06	28.4	133.2	960	75	4.5	TY
	18/09	29.1	133.1	960	75	-	TY
	18/12	29.7	132.9	960	75	4.5	TY
	18/15	30.2	132.8	960	75	-	TY
	18/18	30.8	132.8	960	75	4.5	TY
	18/21	31.3	132.8	960	75	-	TY
	19/00	31.8	132.8	960	75	4.5	TY
	19/03	32.2	132.9	960	75	-	TY
	19/06	32.7	133.1	960	75	4.5	TY
	19/09	32.9	133.6	960	75	-	TY
	19/12	33.3	134.3	960	75	4.5	TY
	19/14	33.6	134.3	960	75	-	TY
	19/15	33.6	134.3	965	70	-	TY
	19/18	33.6	134.5	970	65	4.0	TY
	19/21	33.5	135.0	975	60	-	STS
	20/00	33.5	135.6	980	55	3.5	STS
	20/03	33.5	136.2	980	55	-	STS
	20/06	33.4	136.8	980	55	3.5	STS
	20/09	33.0	137.5	980	55	-	STS
	20/12	32.5	137.9	985	50	3.0	STS
	20/15	32.0	138.1	985	50	-	STS
	20/18	31.7	138.5	985	50	3.0	STS
	20/21	31.1	138.7	985	50	-	STS
	21/00	31.0	139.2	990	45	2.5	TS
	21/03	30.8	140.1	990	45	-	TS
	21/06	30.7	140.9	990	45	2.5	TS
	21/12	30.5	141.7	990	45	2.5	TS
	21/18	29.8	142.2	990	45	2.5	TS
	22/00	29.1	143.0	990	45	2.5	TS
	22/06	29.4	143.9	990	45	2.5	TS
	22/12	30.6	144.3	990	45	2.5	TS
	22/18	31.5	144.6	990	45	2.5	TS
	23/00	32.4	145.0	990	45	2.0	TS
	23/06	33.4	145.5	990	45	2.0	TS
	23/12	34.5	146.2	990	45	2.0	TS
	23/18	36.3	146.9	990	45	2.0	TS
	24/00	37.8	147.9	990	45	2.0	TS
	24/06	39.5	149.2	992	45	2.0	TS
	24/12	41.6	150.3	994	-	1.5	L
	24/18	43.1	151.1	998	-	-	L
	25/00	44.5	152.5	1000	-	-	L
	25/06	45.7	153.1	1000	-	-	L
	25/12	46.1	154.2	1002	-	-	L
	25/18	46.1	155.0	1002	-	-	L
	26/00	45.8	156.5	1004	-	-	L
	26/06	45.5	157.9	1004	-	-	L
	26/12	45.3	159.0	1004	-	-	L
	26/18	45.0	159.3	1004	-	-	L
	27/00	43.8	160.8	1004	-	-	L
	27/06	43.3	161.1	1004	-	-	L
	27/12	42.6	161.0	1004	-	-	L
	27/18	41.9	161.1	1002	-	-	L
	28/00	41.5	161.1	1002	-	-	L
	28/06	41.2	161.0	1000	-	-	L
	28/12	40.7	160.7	1000	-	-	L
	28/18	40.8	161.7	1000	-	-	L
	29/00	42.2	162.2	1000	-	-	L
	29/06	43.6	163.0	1000	-	-	L
	29/12	44.8	163.4	1000	-	-	L
	29/18	45.8	163.4	1000	-	-	L
	30/00	47.1	163.6	1004	-	-	L
	30/06	48.1	163.8	1004	-	-	L
	30/12	49.3	163.8	1008	-	-	L
	30/18	50.7	164.1	1010	-	-	L
	31/00	51.7	164.7	1012	-	-	L
	31/06						Dissip.

Tokage (1207)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul.	13/18	14.9	133.6	1006	-	0.5	TD
	14/00	14.8	133.2	1006	-	0.5	TD
	14/06	14.7	132.7	1004	-	0.5	TD
	14/12	14.4	132.6	1004	-	0.5	TD
	14/18	14.2	132.7	1004	-	1.0	TD
	15/00	14.2	132.9	1000	35	1.5	TS
	15/06	14.0	133.4	1000	35	1.5	TS
	15/12	14.1	134.6	1000	35	1.5	TS
	15/18	14.4	134.6	1002	-	1.5	TD
	16/00						Dissip.

Nock-ten (1108)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul.	24/18	12.7	128.1	1004	-	0.5	TD
	25/00	13.1	127.1	1002	-	1.0	TD
	25/06	13.7	126.1	1000	-	1.5	TD
	25/12	13.9	125.2	1000	-	1.5	TD
	25/18	14.1	124.3	998	-	1.5	TD
	26/00	14.0	123.9	996	35	2.0	TS
	26/06	14.2	123.5	992	40	2.5	TS
	26/12	14.4	123.1	990	45	2.5	TS
	26/18	14.9	122.7	990	45	3.0	TS
	27/00	15.6	122.3	990	45	3.0	TS
	27/06	16.5	121.6	990	45	3.0	TS
	27/12	17.4	120.1	990	45	3.0	TS
	27/18	17.9	118.6	990	45	2.5	TS
	28/00	18.1	116.8	990	45	2.5	TS
	28/06	18.1	115.5	985	50	3.0	STS
	28/12	18.2	114.3	985	50	3.0	STS
	28/18	18.1	113.3	985	50	3.0	STS
	29/00	18.1	112.1	985	50	3.0	STS
	29/06	19.1	111.3	985	50	3.0	STS
	29/12	19.6	110.1	985	50	2.5	STS
	29/18	19.6	109.0	985	50	2.5	STS
	30/00	19.6	107.9	985	50	2.5	STS
	30/06	19.6	106.6	990	45	2.5	TS
	30/12	19.0	105.1	992	40	2.0	TS
	30/18	18.4	103.7	994	35	1.5	TS
	31/00	18.0	102.1	996	-	1.0	TD
	31/06						Dissip.

Muifa (1109)

Date/Time (UTC)		Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Jul.	27/00	10.0	142.0	1006	-	-	TD
	27/06	10.6	140.7	1006	-	0.0	TD
	27/12	11.0	139.1	1006	-	0.0	TD
	27/18	11.2	137.5	1004	-	0.5	TD
	28/00	11.4	135.9	1002	-	1.0	TD
	28/06	11.5	135.0	998	35	1.5	TS
	28/12	11.6	134.1	996	40	2.0	TS
	28/18	11.8	133.8	992	45	2.5	TS
	29/00	12.2	133.9	990	45	2.5	TS
	29/06	13.0	134.1	990	45	3.0	TS
	29/12	13.7	134.2	985	50	3.5	STS
	29/18	14.5	134.2	980	60	4.0	STS
	30/00	15.7	133.9	970	65	4.5	TY
	30/06	16.2	133.1	960	75	5.0	TY
	30/12	16.5	132.7	940	90	6.0	TY
	30/18	16.6	132.4	930	95	6.5	TY
	31/00	16.9	132.6	930	95	6.5	TY
	31/06	17.2	132.9	930	95	6.5	TY
	31/12	17.7	133.5	930	95	6.5	TY
	31/18	18.5	133.5	930	95	6.5	TY
Aug.	01/00	18.9	133.7	935	90	5.5	TY
	01/06	19.8	134.1	945	85	5.5	TY
	01/12	20.6	134.2	945	85	5.5	TY
	01/18	21.4	134.2	945	85	5.5	TY
	02/00	22.0	134.2	945	85	5.5	TY
	02/06	22.7	134.2	945	85	5.5	TY
	02/12	23.3	133.8	945	85	5.5	TY
	02/18	23.8	133.3	945	85	5.5	TY
	03/00	24.2	132.8	945	85	5.5	TY
	03/03	24.2	132.3	945	85	-	TY
	03/06	24.3	132.1	945	85	5.5	TY
	03/09	24.3	131.7	945	85	-	TY
	03/12	24.4	131.4	945	85	5.0	TY
	03/15	24.5	130.9	945	85	-	TY
	03/18	24.5	130.5	945	85	5.0	TY
	03/21	24.6	130.1	945	85	-	TY
	04/00	24.7	129.6	945	85	5.0	TY
	04/03	24.7	129.4	945	85	-	TY
	04/06	24.7	129.2	945	85	5.0	TY
	04/09	24.8	128.9	945	85	-	TY
	04/12	24.9	128.7	945	85	5.0	TY
	04/15	25.0	128.5	945	85	-	TY
	04/18	25.0	128.2	945	85	5.0	TY
	04/21	25.1	128.0	945	85	-	TY
	05/00	25.3	127.8	945	85	5.0	TY
	05/03	25.5	127.4	945	85	-	TY
	05/06	25.7	127.3	945	85	5.0	TY
	05/09	25.8	127.1	945	85	-	TY
	05/12	26.1	127.0	950	80	5.0	TY
	05/13	26.3	126.8	950	80	-	TY
	05/15	26.4	126.6	950	80	-	TY
	05/18	26.5	126.3	950	80	4.5	TY
	05/21	27.0	126.2	955	75	-	TY
	06/00	27.6	125.8	955	75	4.0	TY
	06/03	28.1	125.5	955	75	-	TY
	06/06	28.5	125.3	960	70	4.0	TY
	06/09	29.0	125.1	960	70	-	TY
	06/12	29.4	125.0	965	65	4.0	TY
	06/18	30.5	124.7	965	65	4.0	TY
	07/00	31.9	124.4	970	65	3.5	TY
	07/06	33.2	124.1	975	60	3.5	STS
	07/12	34.6	123.9	975	60	3.5	STS
	07/18	35.8	123.6	980	55	3.0	STS
	08/00	37.4	123.9	980	55	2.5	STS
	08/06	38.6	124.3	985	50	2.5	STS
	08/12	40.6	124.7	990	40	2.0	TS
	08/18	42.4	125.1	992	35	2.0	TS
	09/00	44.3	126.5	996	-	2.0	TD
	09/06	45.6	128.4	996	-	-	TD
	09/12	46.5	129.6	996	-	-	L
	09/18	47.3	131.5	994	-	-	L
	10/00	48.1	133.6	992	-	-	L
	10/06	48.7	135.1	990	-	-	L
	10/12	49.6	137.5	988	-	-	L
	10/18	49.7	139.8	984	-	-	L
	11/00	50.0	141.1	982	-	-	L
	11/06	50.1	142.1	982	-	-	L
	11/12	50.1	142.8	982	-	-	L
	11/18	49.8	144.0	984	-	-	L
	12/00	49.7	145.1	986	-	-	L
	12/06	50.9	147.4	986	-	-	L
	12/12	52.7	147.5	986	-	-	L
	12/18	54.4	147.2	984	-	-	L
	13/00	55.0	145.5	984	-	-	L
	13/06	55.0	145.8	984	-	-	L
	13/12	55.0	146.7	986	-	-	L
	13/18	55.3	147.6	988	-	-	L
	14/00	55.7	147.7	992	-	-	L
	14/06	56.3	148.1	994	-	-	L
	14/12	56.9	148.1	994	-	-	L
	14/18	57.3	147.5	996	-	-	L
	15/00	57.4	147.0	996	-	-	L
	15/06	57.4	146.3	998	-	-	L
	15/12	57.5	146.0	1000	-	-	L
	15/18						Dissip.

Merbok (1110)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug. 02/18	23.2	163.0	1006	-	1.0	TD
03/00	23.2	161.8	1004	-	1.0	TD
03/06	23.2	160.5	1000	35	2.0	TS
03/12	23.2	159.8	1000	35	2.0	TS
03/18	23.5	159.1	1000	35	2.0	TS
04/00	24.4	158.3	1000	35	2.0	TS
04/06	24.7	157.2	998	35	2.0	TS
04/12	24.9	156.8	998	35	2.0	TS
04/18	25.2	156.4	998	35	2.0	TS
05/00	26.3	155.6	994	40	2.5	TS
05/06	26.9	155.3	990	45	3.0	TS
05/12	27.2	154.8	990	45	3.0	TS
05/18	27.5	154.4	990	45	3.0	TS
06/00	28.1	154.0	985	50	3.5	STS
06/06	28.7	153.8	985	50	3.5	STS
06/12	29.3	153.7	985	50	3.5	STS
06/18	30.2	153.7	985	50	3.5	STS
07/00	30.8	153.9	985	50	3.5	STS
07/06	31.6	154.1	985	50	3.5	STS
07/12	32.4	154.8	985	50	3.0	STS
07/18	33.1	155.5	980	50	3.0	STS
08/00	34.2	156.2	980	50	3.0	STS
08/06	35.7	157.7	980	50	3.0	STS
08/12	37.3	159.1	980	50	2.5	STS
08/18	39.1	160.2	980	50	2.5	STS
09/00	40.4	160.6	980	50	2.5	STS
09/06	41.3	161.2	985	45	2.5	TS
09/12	41.9	162.7	985	45	2.0	TS
09/18	43.3	164.1	988	-	2.0	L
10/00	44.5	164.5	988	-	-	L
10/06	45.4	165.4	988	-	-	L
10/12	47.2	165.7	988	-	-	L
10/18	48.7	165.9	988	-	-	L
11/00	50.0	165.7	988	-	-	L
11/06	50.8	166.4	990	-	-	L
11/12	51.5	166.3	992	-	-	L
11/18	52.0	166.4	996	-	-	L
12/00	53.3	166.3	998	-	-	L
12/06						Dissip.

Nanmadol (1111)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug. 21/12	12.4	128.6	1004	-	1.0	TD
21/18	13.1	128.3	1004	-	0.5	TD
22/00	13.8	128.0	1004	-	0.5	TD
22/06	14.3	127.8	1004	-	0.5	TD
22/12	14.6	127.6	1004	-	1.0	TD
22/18	15.0	127.4	1004	-	1.0	TD
23/00	15.3	127.3	1002	-	1.5	TD
23/06	15.4	127.2	1000	-	2.0	TD
23/12	15.6	127.2	996	35	2.5	TS
23/18	15.8	127.1	994	40	3.0	TS
24/00	16.0	127.0	992	45	3.0	TS
24/06	16.1	126.8	990	50	3.5	STS
24/12	15.9	126.4	985	55	3.5	STS
24/18	16.0	126.0	980	60	4.0	STS
25/00	16.2	125.6	975	65	4.5	TY
25/06	16.3	125.2	965	75	5.0	TY
25/12	16.5	124.5	955	80	5.5	TY
25/18	16.4	124.0	940	90	6.5	TY
26/00	16.7	123.9	925	100	7.0	TY
26/06	17.2	123.6	925	100	7.0	TY
26/12	17.5	123.3	925	100	7.0	TY
26/18	17.9	122.8	935	95	7.0	TY
27/00	18.1	122.4	945	90	6.0	TY
27/06	18.7	121.9	950	85	6.0	TY
27/12	19.3	121.7	955	80	5.5	TY
27/18	19.7	121.3	970	70	5.0	TY
28/00	20.4	121.4	975	65	4.5	TY
28/06	20.9	121.2	975	65	4.5	TY
28/12	21.6	121.0	980	60	4.0	STS
28/18	22.1	121.0	980	60	4.0	STS
29/00	22.8	120.3	985	55	4.0	STS
29/06	23.1	119.9	990	50	3.5	STS
29/12	23.5	119.7	990	50	3.5	STS
29/18	23.7	119.5	992	45	3.0	TS
30/00	23.9	119.4	992	45	3.0	TS
30/06	24.4	119.2	992	40	2.5	TS
30/12	24.5	119.1	992	40	2.5	TS
30/18	24.6	118.9	994	35	2.0	TS
31/00	24.7	118.6	996	-	2.0	TD
31/06	24.7	117.7	996	-	2.0	TD
31/12	24.4	116.9	998	-	-	TD
31/18						Dissip.

Talas (1112)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Aug. 23/18	15.2	142.7	1004	-	0.0	TD
24/00	15.6	141.8	1002	-	0.5	TD
24/06	16.1	141.7	1002	-	0.5	TD
24/12	16.8	141.2	1002	-	1.0	TD
24/18	17.5	140.8	1002	-	1.5	TD
25/00	18.4	140.6	998	35	2.0	TS
25/06	19.1	140.5	996	35	2.0	TS
25/12	19.7	140.4	994	40	2.5	TS
25/18	20.3	140.5	990	40	3.0	TS
26/00	21.0	140.5	985	45	3.0	TS
26/06	21.5	140.2	985	45	3.0	TS
26/12	22.1	139.8	985	45	3.0	TS
26/18	22.3	139.6	980	45	3.0	TS
27/00	22.4	139.6	980	45	3.0	TS
27/06	22.5	139.6	980	45	3.0	TS
27/12	22.6	139.5	975	50	3.0	STS
27/18	22.6	139.5	975	50	3.0	STS
28/00	22.8	139.5	975	50	3.0	STS
28/06	23.0	139.7	975	50	3.0	STS
28/12	23.3	140.1	975	50	3.0	STS
28/18	23.5	140.2	975	50	3.0	STS
29/00	23.7	140.1	975	50	3.5	STS
29/06	23.8	140.1	975	50	3.5	STS
29/12	24.1	140.1	970	50	3.5	STS
29/18	24.7	140.1	970	50	3.5	STS
30/00	25.2	140.1	970	50	3.5	STS
30/06	25.8	139.8	970	50	3.5	STS
30/09	26.0	139.6	970	50	-	STS
30/12	26.1	139.3	970	50	3.5	STS
30/15	26.3	138.8	970	50	-	STS
30/18	26.5	138.4	970	50	3.5	STS
30/21	26.4	138.0	970	50	-	STS
31/00	26.5	137.9	970	50	3.5	STS
31/03	26.7	137.6	970	50	-	STS
31/06	26.8	137.4	970	50	3.5	STS
31/09	26.9	137.3	970	50	-	STS
31/12	27.1	137.1	970	50	3.5	STS
31/15	27.3	136.9	970	50	-	STS
31/18	27.4	136.6	970	50	3.5	STS
31/21	27.5	136.5	970	50	-	STS
Sep. 01/00	27.8	136.3	970	50	3.5	STS
01/03	28.1	136.2	970	50	-	STS
01/06	28.3	136.0	970	50	3.5	STS
01/09	28.5	135.8	970	50	-	STS
01/12	28.8	135.6	970	50	3.5	STS
01/15	29.0	135.4	970	50	-	STS
01/18	29.4	135.2	970	50	3.5	STS
01/21	29.9	135.1	970	50	-	STS
02/00	30.3	134.9	970	50	3.5	STS
02/03	30.8	134.6	970	50	-	STS
02/06	31.3	134.5	970	50	3.5	STS
02/09	31.7	134.5	970	50	-	STS
02/12	32.2	134.3	970	50	3.5	STS
02/15	32.6	134.0	975	50	-	STS
02/18	33.0	133.8	975	50	3.0	STS
02/21	33.2	133.8	980	50	-	STS
03/00	33.4	133.9	982	50	3.0	STS
03/01	33.6	133.9	984	50	-	STS
03/03	33.8	133.9	985	50	-	STS
03/06	34.0	133.9	985	50	3.0	STS
03/09	34.4	133.9	988	45	-	TS
03/12	34.7	134.0	990	45	2.5	TS
03/15	35.0	133.9	992	45	-	TS
03/18	35.4	133.7	992	45	2.5	TS
03/21	35.6	133.7	994	40	-	TS
04/00	35.8	133.7	994	40	2.0	TS
04/03	36.0	133.8	994	40	-	TS
04/06	36.1	133.9	994	40	2.0	TS
04/09	36.4	134.0	994	40	-	TS
04/12	36.7	134.1	994	40	2.0	TS
04/15	37.0	134.3	994	40	-	TS
04/18	37.3	134.5	994	40	2.0	TS
04/21	37.8	135.0	994	40	-	TS
05/00	39.4	136.3	994	40	1.5	TS
05/06	41.5	136.2	992	-	1.5	L
05/12	42.5	136.4	992	-	-	L
05/18	43.7	136.0	992	-	-	L
06/00	44.7	135.8	992	-	-	L
06/06	45.0	135.6	992	-	-	L
06/12	45.0	135.2	992	-	-	L
06/18	44.7	136.5	992	-	-	L
07/00	45.2	137.4	992	-	-	L
07/06	45.8	138.0	992	-	-	L
07/12						Dissip.

Noru (1113)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 02/00	21.3	149.8	1004	-	0.5	TD
02/06	20.9	149.0	1004	-	0.5	TD
02/12	20.2	148.3	1002	-	0.5	TD
02/18	19.7	147.8	1002	-	1.0	TD
03/00	19.8	148.2	1002	-	1.5	TD
03/06	20.6	149.3	1000	-	1.5	TD
03/12	22.2	150.3	998	35	2.0	TS
03/18	24.7	151.4	996	40	2.0	TS
04/00	27.5	151.4	996	40	2.0	TS
04/06	29.4	150.8	994	40	2.0	TS
04/12	30.8	150.1	994	40	2.0	TS
04/18	32.2	149.6	992	40	2.0	TS
05/00	33.4	149.6	992	40	2.0	TS
05/06	35.1	150.0	990	40	1.5	TS
05/12	36.5	148.5	990	40	1.5	TS
05/18	36.8	148.4	990	40	1.5	TS
06/00	37.9	149.4	990	40	1.5	TS
06/06	39.4	150.1	990	40	1.5	TS
06/12	41.4	150.8	990	-	1.5	L
06/18	43.8	148.9	990	-	-	L
07/00	46.2	149.3	992	-	-	L
07/06	49.6	145.2	988	-	-	L
07/12	51.5	141.4	986	-	-	L
07/18	53.1	141.2	984	-	-	L
08/00	54.8	141.0	984	-	-	L
08/06	55.9	141.3	984	-	-	L
08/12	57.0	141.8	986	-	-	L
08/18	58.2	142.5	986	-	-	L
09/00	59.2	142.7	982	-	-	L
09/06	61.5	141.6	984	-	-	Out

Kulap (1114)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 06/06	19.5	134.5	1004	-	1.0	TD
06/12	20.3	134.9	1004	-	1.0	TD
06/18	20.8	135.1	1004	-	1.5	TD
07/00	21.2	135.3	1002	35	2.0	TS
07/06	21.6	135.7	1000	35	2.0	TS
07/12	22.7	135.8	1000	35	2.0	TS
07/18	23.7	135.2	1000	35	2.0	TS
08/00	24.6	134.2	1000	35	2.0	TS
08/06	25.5	133.6	1000	35	2.0	TS
08/12	26.3	132.6	1002	35	2.0	TS
08/18	27.1	131.4	1004	35	1.5	TS
09/00	28.1	131.0	1008	-	1.5	TD
09/06	29.2	130.1	1008	-	1.5	TD
09/12	30.0	128.9	1010	-	1.5	TD
09/18	30.3	127.9	1010	-	1.5	TD
10/00	30.7	127.6	1012	-	1.5	TD
10/06	31.7	127.2	1012	-	-	TD
10/12	32.1	126.7	1012	-	-	TD
10/18	32.8	126.5	1012	-	-	TD
11/00	33.4	126.5	1014	-	-	TD
11/06						Dissip.

Roke (1115)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 09/12	20.4	144.7	1008	-	-	TD
09/18	20.3	143.6	1006	-	-	TD
10/00	20.2	142.8	1008	-	-	TD
10/06	20.1	141.9	1006	-	-	TD
10/12	20.4	140.9	1004	-	-	TD
10/18	20.4	139.6	1002	-	-	TD
11/00	20.3	138.5	1002	-	-	TD
11/06	20.3	137.3	1002	-	-	TD
11/12	20.5	136.4	1002	-	-	TD
11/18	20.9	135.8	1002	-	-	TD
12/00	21.5	136.2	1002	-	0.0	TD
12/06	21.8	136.9	1002	-	0.0	TD
12/12	21.9	137.5	1000	-	0.5	TD
12/18	22.2	138.0	1000	-	1.0	TD
13/00	22.6	138.3	1000	-	1.0	TD
13/06	23.0	138.2	998	35	1.5	TS
13/12	23.4	138.1	998	35	1.5	TS
13/18	23.8	137.8	998	35	1.5	TS
14/00	24.3	137.6	996	35	1.5	TS
14/06	24.6	136.9	996	35	1.5	TS
14/12	25.1	135.3	994	35	1.5	TS
14/18	25.3	133.5	994	35	1.5	TS
15/00	25.4	132.5	992	35	1.5	TS
15/06	25.7	131.5	990	40	2.0	TS
15/12	25.8	131.0	990	40	2.0	TS
15/18	26.0	130.4	990	40	2.5	TS
16/00	26.3	130.1	990	40	2.5	TS
16/06	26.4	129.9	985	45	3.0	TS
16/12	26.1	129.6	985	45	3.0	TS
16/18	25.6	129.7	985	45	3.0	TS
17/00	25.2	129.7	985	45	3.0	TS
17/06	25.0	129.8	980	50	3.5	STS
17/12	24.8	130.3	980	55	3.5	STS
17/18	24.8	130.5	975	60	4.0	STS
18/00	25.3	131.1	975	60	4.0	STS
18/03	25.6	131.0	975	60	-	STS
18/06	25.9	130.8	975	60	4.0	STS
18/09	26.1	130.7	975	60	-	STS
18/12	26.2	130.5	975	60	4.0	STS
18/15	26.3	130.5	975	60	-	STS
18/18	26.4	130.4	975	60	4.0	STS
18/21	26.5	130.5	975	60	-	STS
19/00	26.7	130.5	975	60	4.0	STS
19/03	27.2	130.6	975	60	-	STS
19/06	27.7	130.4	975	60	4.5	STS
19/09	28.0	130.3	975	60	-	STS
19/12	28.2	130.2	970	65	5.5	TY
19/15	28.2	130.4	970	65	-	TY
19/18	28.2	130.6	965	70	5.5	TY
19/21	28.4	131.2	965	70	-	TY
20/00	28.9	131.6	960	75	5.5	TY
20/03	29.2	131.8	960	75	-	TY
20/06	29.3	132.3	950	80	6.0	TY
20/09	29.7	133.0	950	80	-	TY
20/12	30.3	133.6	940	85	6.5	TY
20/15	30.9	134.1	940	85	-	TY
20/18	31.7	134.7	940	85	6.5	TY
20/21	32.4	135.3	940	85	-	TY
21/00	33.0	135.9	950	80	6.5	TY
21/03	33.9	136.9	950	80	-	TY
21/05	34.7	137.6	950	80	-	TY
21/06	34.9	137.8	955	75	5.5	TY
21/09	35.9	139.2	970	70	-	TY
21/12	37.1	140.7	975	65	5.5	TY
21/15	38.7	142.4	975	65	-	TY
21/18	40.5	143.6	975	65	5.0	TY
21/21	41.8	145.0	975	65	-	TY
22/00	42.7	146.6	980	60	4.5	STS
22/03	43.6	147.8	980	60	-	STS
22/06	44.5	149.0	982	-	4.0	L
22/12	45.8	151.2	984	-	-	L
22/18	46.8	152.9	988	-	-	L
23/00	47.8	155.6	992	-	-	L
23/06	49.0	159.4	996	-	-	L
23/12	50.7	163.8	996	-	-	L
23/18	51.4	167.7	998	-	-	L
24/00	51.9	172.5	1000	-	-	L
24/06	51.9	178.4	1000	-	-	L
24/12	51.2	185.4	1000	-	-	Out

Sonca (1116)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 14/12	20.6	154.4	1010	-	-	TD
14/18	21.0	154.9	1008	-	1.0	TD
15/00	21.4	155.1	1006	-	1.5	TD
15/06	22.1	155.2	1004	35	1.5	TS
15/12	22.5	154.8	1004	35	1.5	TS
15/18	23.0	154.1	1004	35	1.5	TS
16/00	22.8	152.8	1002	40	2.0	TS
16/06	23.0	151.5	1000	40	2.5	TS
16/12	23.1	150.2	1000	40	2.5	TS
16/18	23.3	148.9	1000	40	2.5	TS
17/00	24.6	147.7	996	45	3.0	TS
17/06	25.6	146.0	990	50	3.5	STS
17/12	26.4	144.4	985	55	4.0	STS
17/18	27.4	143.4	985	55	4.0	STS
18/00	28.7	142.7	980	60	4.5	STS
18/06	30.2	142.5	975	65	4.5	TY
18/12	31.7	142.5	975	65	4.5	TY
18/18	33.1	142.9	975	65	4.5	TY
19/00	34.6	144.3	970	70	5.0	TY
19/06	36.0	146.1	970	70	5.0	TY
19/12	37.2	148.4	970	70	5.0	TY
19/18	38.6	151.5	970	70	5.0	TY
20/00	39.8	155.4	975	65	4.5	TY
20/06	40.7	160.2	980	60	4.0	STS
20/12	42.0	165.0	990	-	3.5	L
20/18	42.6	169.4	994	-	-	L
21/00	43.1	175.1	996	-	-	L
21/06	43.3	180.3	998	-	-	Out

Nesat (1117)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 23/00	12.6	139.2	1006	-	0.5	TD
23/06	12.9	138.7	1004	-	0.5	TD
23/12	13.3	138.3	1004	-	1.0	TD
23/18	13.7	137.6	1004	-	1.5	TD
24/00	14.2	136.5	1000	35	2.0	TS
24/06	14.8	134.9	998	35	2.5	TS
24/12	15.0	133.6	994	40	2.5	TS
24/18	14.5	131.9	990	45	3.0	TS
25/00	14.4	130.6	985	50	3.5	STS
25/06	14.5	129.2	985	50	3.5	STS
25/12	14.6	128.3	980	55	3.5	STS
25/18	14.9	127.0	975	60	4.0	STS
26/00	15.1	126.0	965	70	4.5	TY
26/06	15.4	125.0	965	70	4.5	TY
26/12	15.8	124.0	960	75	4.5	TY
26/18	16.2	122.9	950	80	5.5	TY
27/00	16.3	121.5	960	75	4.5	TY
27/06	16.5	120.2	970	65	4.0	TY
27/12	16.9	119.1	970	65	4.0	TY
27/18	17.2	117.9	970	65	4.0	TY
28/00	17.1	116.6	970	65	4.0	TY
28/06	17.4	115.8	970	65	4.0	TY
28/12	18.2	114.6	970	65	4.0	TY
28/18	18.8	113.4	970	65	4.0	TY
29/00	19.7	112.2	970	65	4.0	TY
29/06	19.9	110.8	970	65	4.0	TY
29/12	20.2	109.8	970	65	3.5	TY
29/18	20.6	108.9	980	55	3.5	STS
30/00	20.8	107.8	985	50	3.0	STS
30/06	20.9	106.8	992	45	3.0	TS
30/12	21.1	106.5	998	35	2.5	TS
30/18	21.5	106.2	1004	-	2.0	TD
Oct. 01/00						Dissip.

Haitang (1118)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 24/00	15.8	110.9	1000	-	0.0	TD
24/06	15.3	111.3	998	-	0.5	TD
24/12	15.3	112.4	998	-	0.5	TD
24/18	15.8	113.0	998	-	0.5	TD
25/00	16.4	113.1	996	35	1.0	TS
25/06	17.0	112.6	996	35	1.5	TS
25/12	17.0	112.1	996	35	2.0	TS
25/18	16.8	111.7	996	35	2.0	TS
26/00	16.6	111.2	996	35	2.0	TS
26/06	16.4	110.8	998	35	2.0	TS
26/12	16.2	110.0	998	35	2.0	TS
26/18	16.1	108.8	1000	-	2.5	TD
27/00	16.6	107.5	1000	-	2.0	TD
27/06						Dissip.

Nalgae (1119)

Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Sep. 26/12	18.3	139.6	1008	-	0.5	TD
26/18	18.5	138.7	1006	-	1.0	TD
27/00	18.8	138.0	1008	-	1.5	TD
27/06	18.9	137.8	1004	-	1.5	TD
27/12	18.9	137.6	1004	-	1.5	TD
27/18	19.0	137.2	1000	35	2.0	TS
28/00	19.1	136.8	998	40	2.5	TS
28/06	19.1	136.4	994	45	3.0	TS
28/12	18.7	135.9	990	50	3.0	STS
28/18	18.4	135.2	985	55	3.5	STS
29/00	18.1	134.2	980	60	3.5	STS
29/06	17.8	133.1	975	65	4.0	TY
29/12	17.6	131.7	965	75	5.0	TY
29/18	17.7	130.4	960	80	5.0	TY
30/00	17.7	129.0	955	80	5.0	TY
30/06	17.8	127.4	950	85	5.0	TY
30/12	17.6	125.8	940	90	6.0	TY
30/18	16.9	124.1	940	90	6.0	TY
Oct. 01/00	16.8	122.7	935	95	6.5	TY
01/06	16.6	121.3	950	85	5.5	TY
01/12	16.4	119.7	965	75	5.0	TY
01/18	16.4	118.8	965	70	4.5	TY
02/00	16.5	117.6	970	65	4.5	TY
02/06	16.7	116.6	975	60	4.0	STS
02/12	17.1	115.6	980	55	3.5	STS
02/18	17.5	114.9	985	50	3.0	STS
03/00	17.6	114.3	985	50	3.0	STS
03/06	17.8	113.5	985	50	3.0	STS
03/12	17.8	112.8	985	50	3.0	STS
03/18	17.9	111.9	990	45	3.0	TS
04/00	18.1	111.0	992	45	3.0	TS
04/06	18.5	109.9	996	40	2.5	TS
04/12	18.3	108.7	1000	35	2.5	TS
04/18	18.3	108.5	1004	-	2.0	TD
05/00	18.2	108.2	1006	-	2.0	TD
05/06	18.1	108.0	1006	-	2.0	TD
05/12	18.0	107.5	1008	-	-	TD
05/18						Dissip.

Banyan (1120)

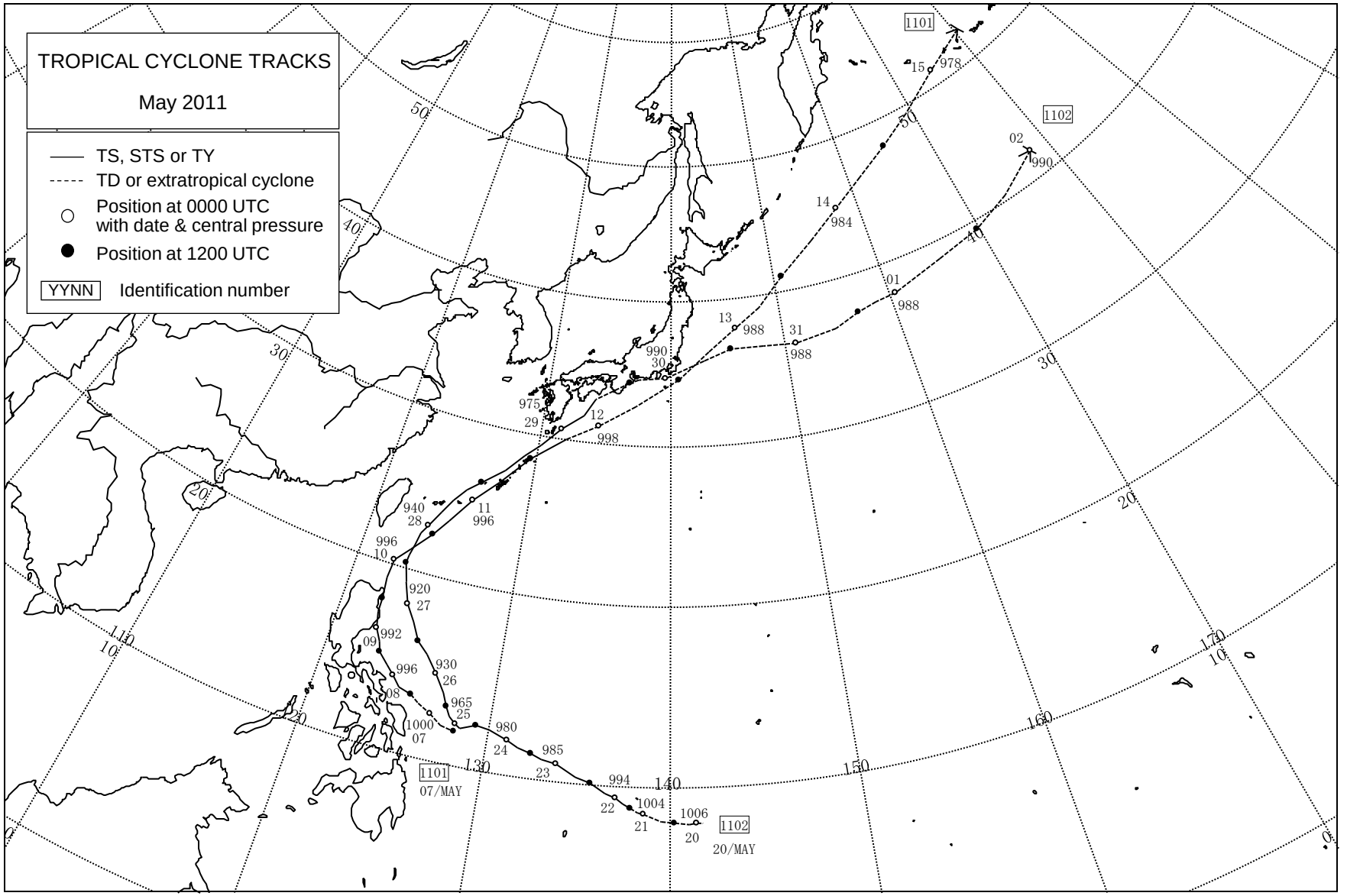
Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Oct. 09/06	8.1	135.5	1008	-	1.0	TD
09/12	7.8	134.5	1006	-	1.0	TD
09/18	7.3	133.2	1006	-	1.5	TD
10/00	7.3	131.8	1006	-	1.5	TD
10/06	7.2	130.5	1004	-	2.0	TD
10/12	7.4	129.7	1004	-	2.0	TD
10/18	7.7	128.9	1002	35	2.0	TS
11/00	8.1	128.0	1002	35	2.0	TS
11/06	8.7	127.2	1004	-	2.0	TD
11/12	9.6	126.3	1004	-	2.0	TD
11/18	10.7	125.8	1004	-	1.5	TD
12/00	11.5	124.5	1006	-	1.5	TD
12/06	11.6	122.5	1006	-	1.5	TD
12/12	11.6	121.0	1006	-	1.5	TD
12/18	12.0	119.6	1006	-	1.5	TD
13/00	12.7	118.8	1006	-	1.5	TD
13/06	13.6	118.2	1006	-	1.5	TD
13/12	14.5	117.4	1006	-	1.5	TD
13/18	16.0	117.2	1006	-	1.5	TD
14/00	17.3	117.1	1008	-	1.5	TD
14/06	18.2	117.2	1006	-	1.5	TD
14/12						Dissip.

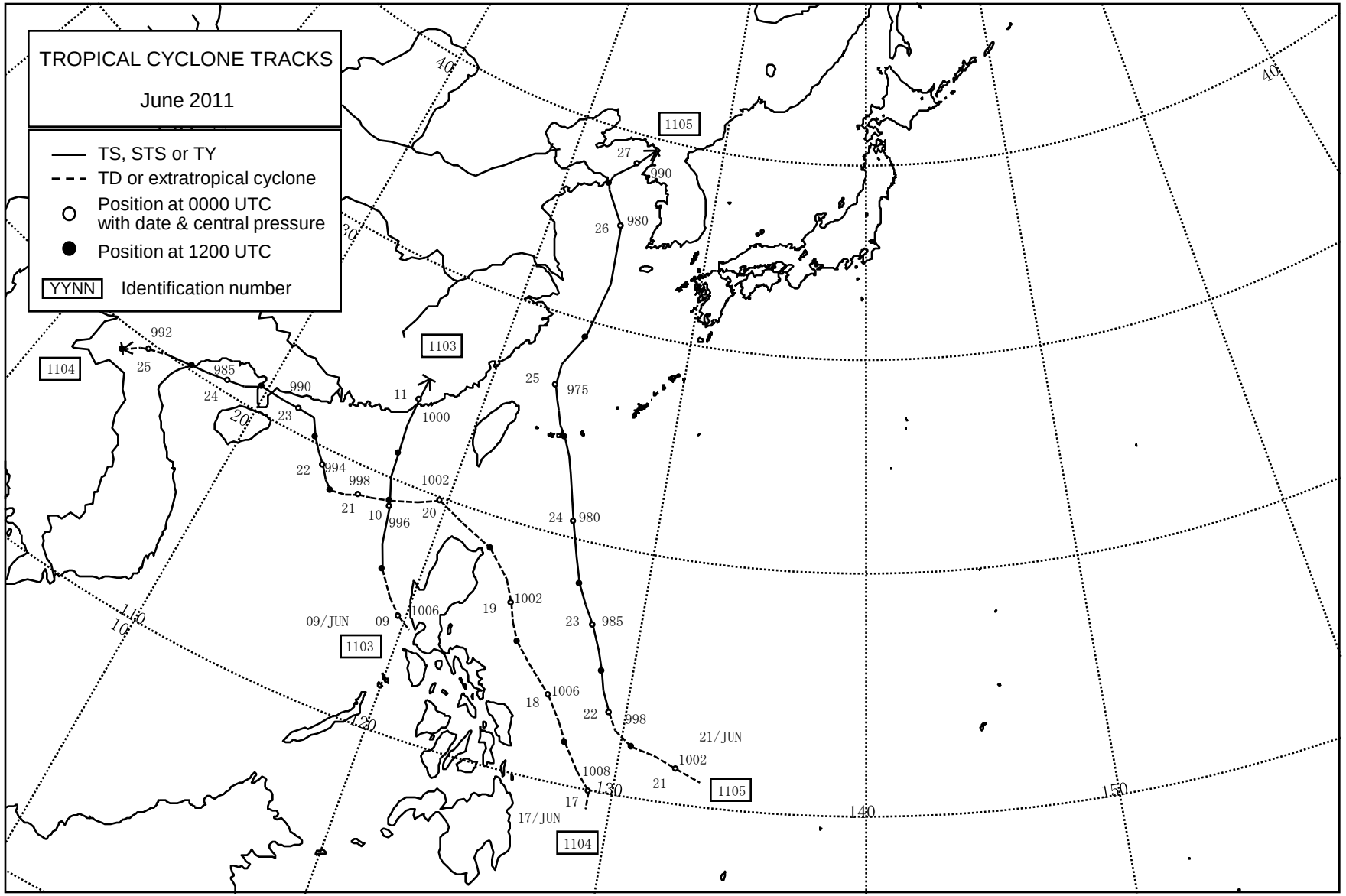
Washi (1121)

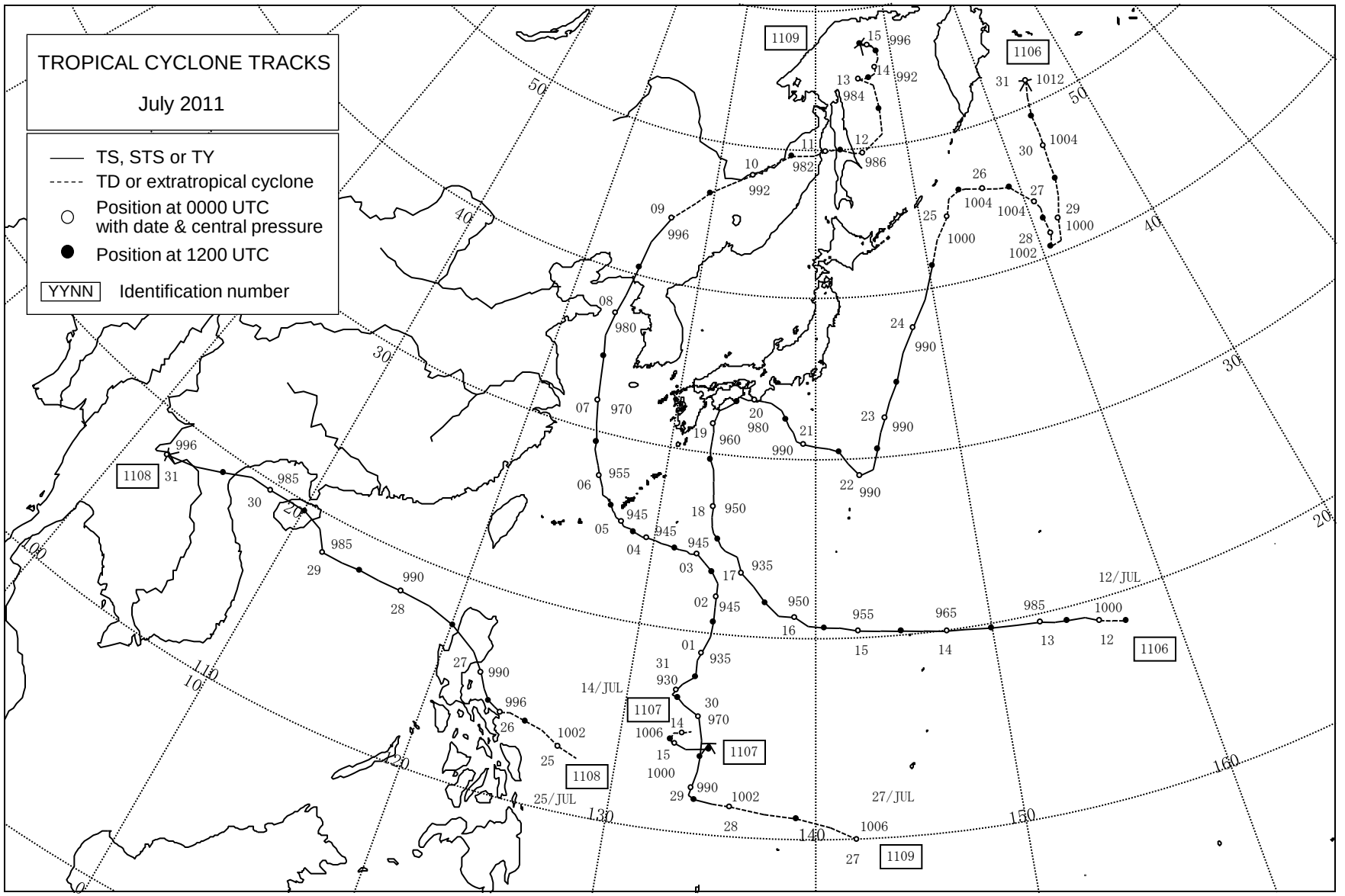
Date/Time (UTC)	Center position Lat (N)	Lon (E)	Central pressure (hPa)	Max wind (kt)	CI num.	Grade
Dec. 13/06	6.2	145.0	1004	-	0.5	TD
13/12	6.1	143.4	1006	-	0.5	TD
13/18	6.0	142.0	1004	-	1.0	TD
14/00	5.8	140.6	1006	-	1.5	TD
14/06	6.0	139.1	1004	-	1.5	TD
14/12	6.4	137.6	1006	-	1.5	TD
14/18	6.9	136.0	1004	-	1.5	TD
15/00	7.3	134.1	1004	-	1.5	TD
15/06	7.5	132.6	1000	35	2.0	TS
15/12	7.5	130.8	998	40	2.5	TS
15/18	7.4	129.4	998	40	2.5	TS
16/00	7.5	128.1	996	45	2.5	TS
16/06	7.9	126.9	992	50	3.0	STS
16/12	8.2	125.3	998	40	2.5	TS
16/18	8.7	124.0	1000	35	2.5	TS
17/00	9.0	122.5	996	40	2.5	TS
17/06	9.2	121.3	996	40	2.5	TS
17/12	9.7	120.1	996	40	2.5	TS
17/18	10.3	118.7	998	35	2.5	TS
18/00	10.1	117.0	998	35	2.5	TS
18/06	9.9	115.5	1000	35	2.5	TS
18/12	9.9	114.8	1002	35	2.5	TS
18/18	9.8	114.2	1002	35	2.5	TS
19/00	9.6	113.2	1006	-	2.5	TD
19/06						Dissip.

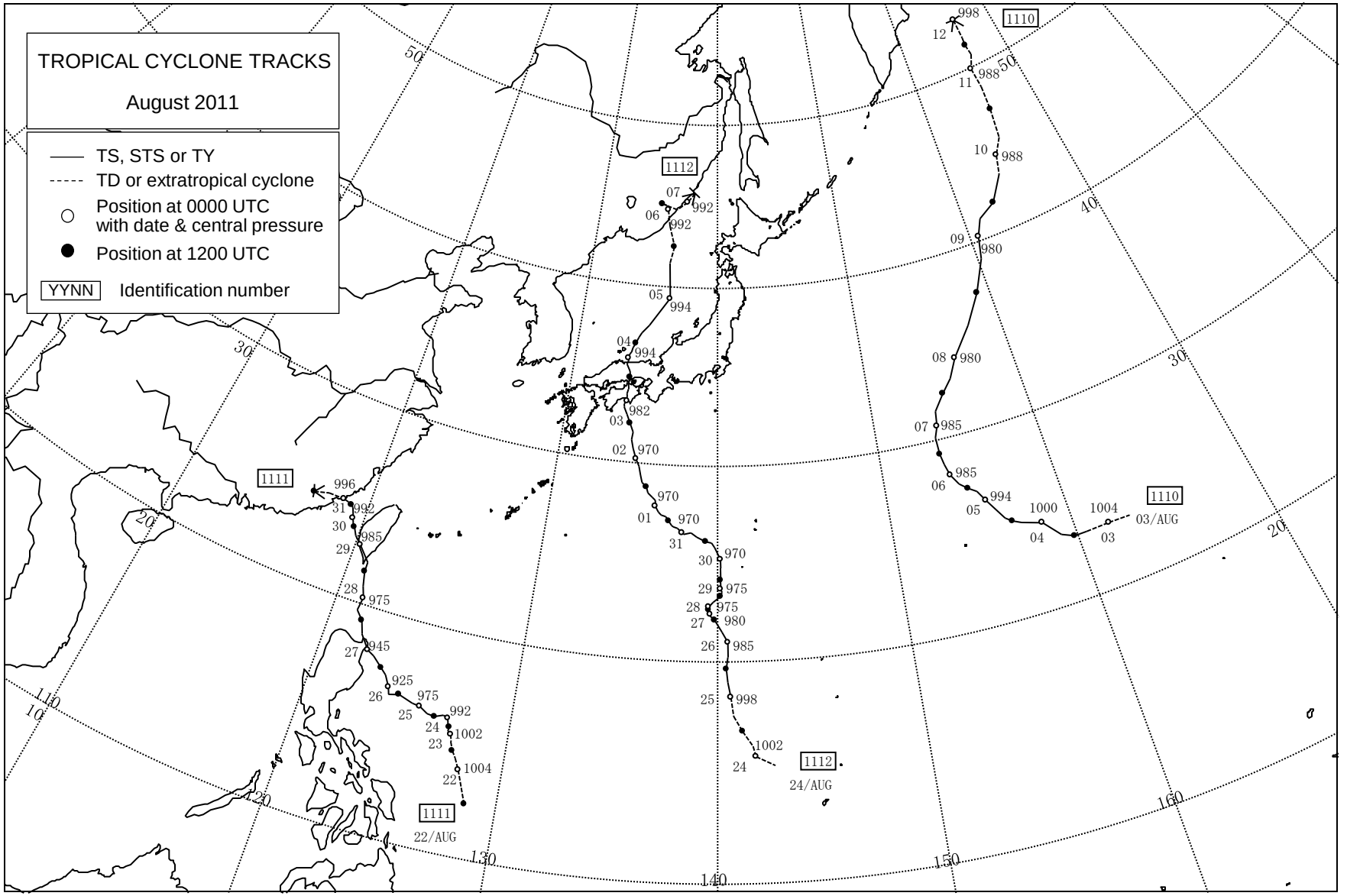
Appendix 2

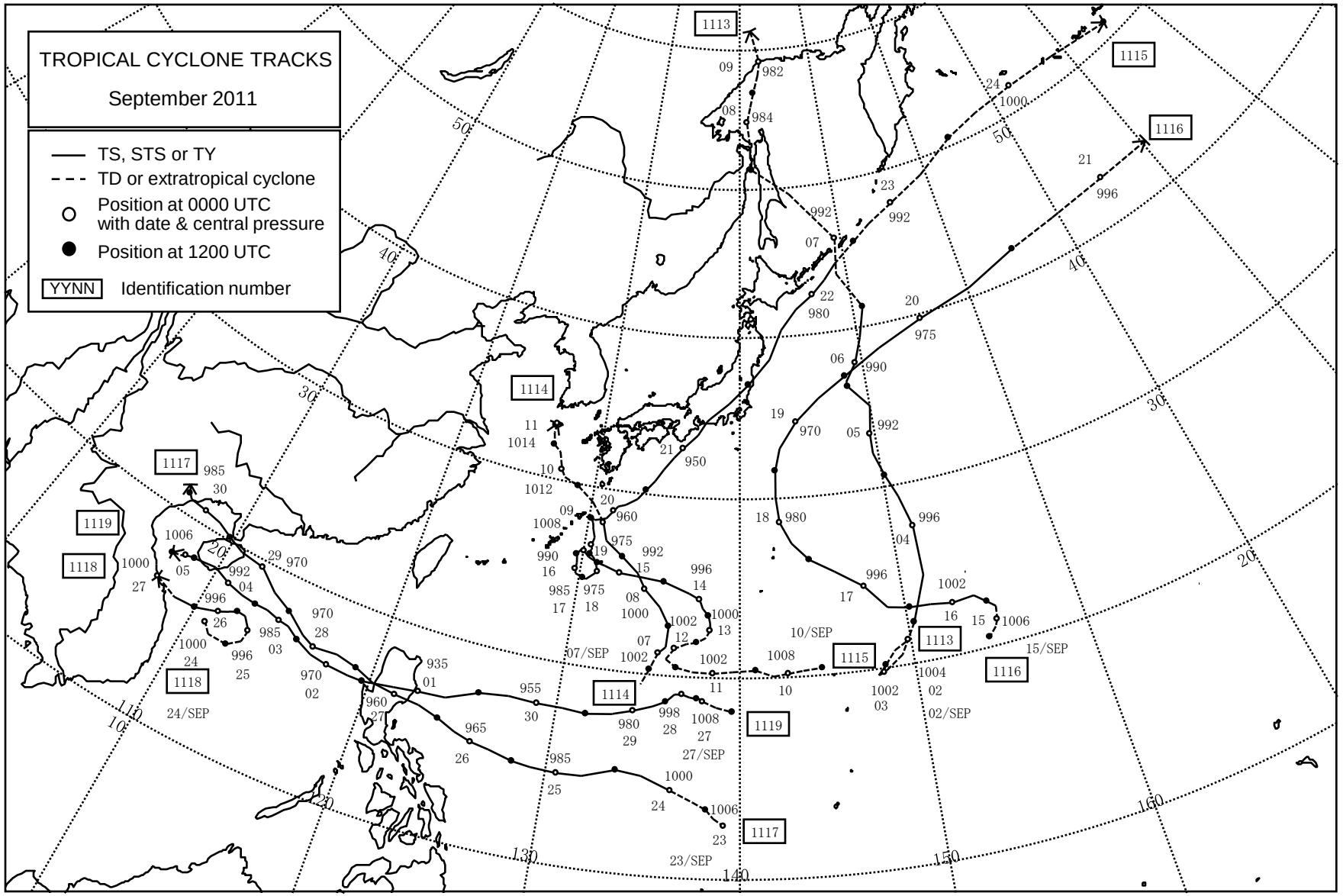
Monthly Tracks of Tropical Cyclones in 2011

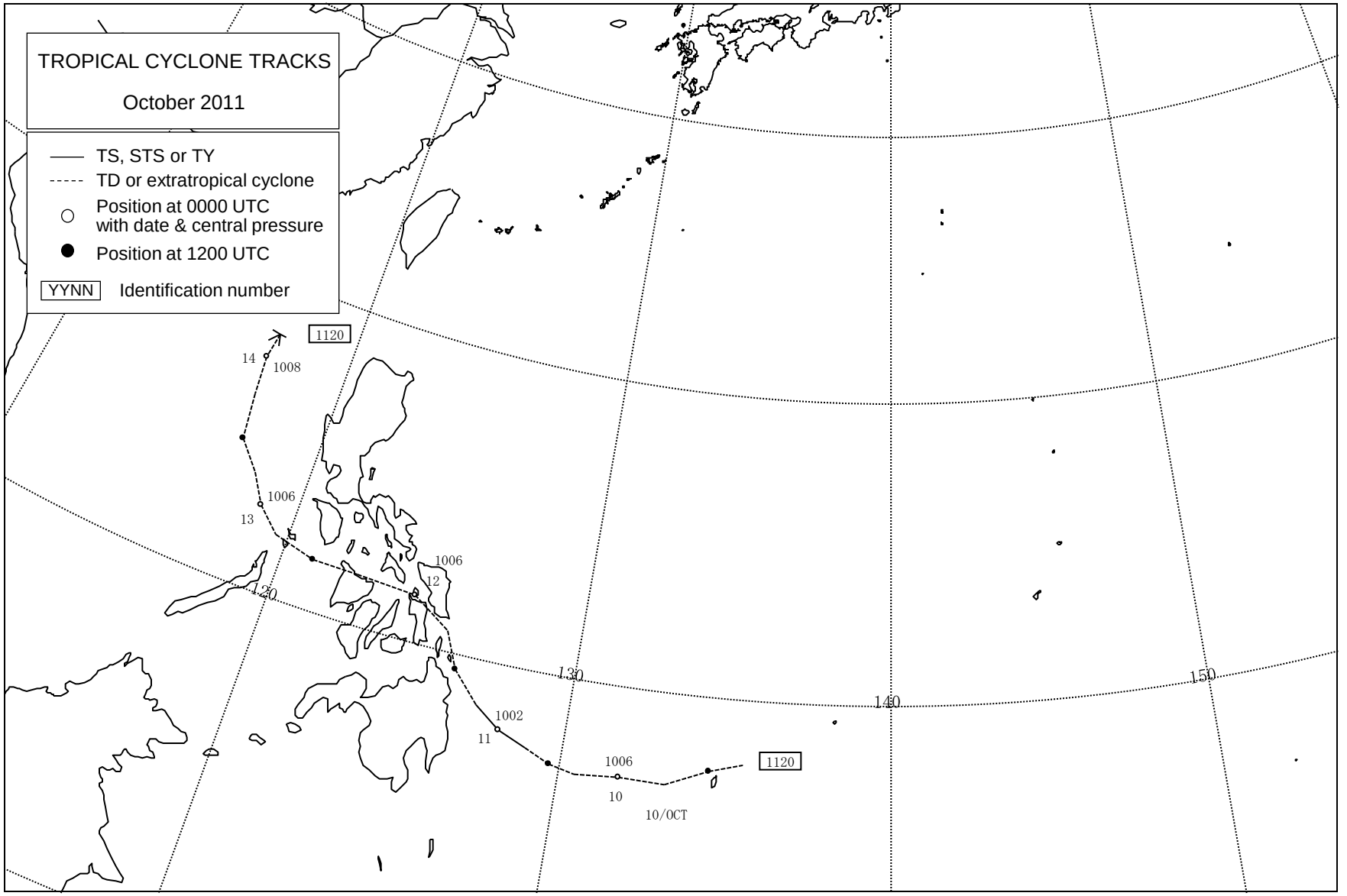

TROPICAL CYCLONE TRACKS
May 2011
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1101
1102
07/MAY
20/MAY

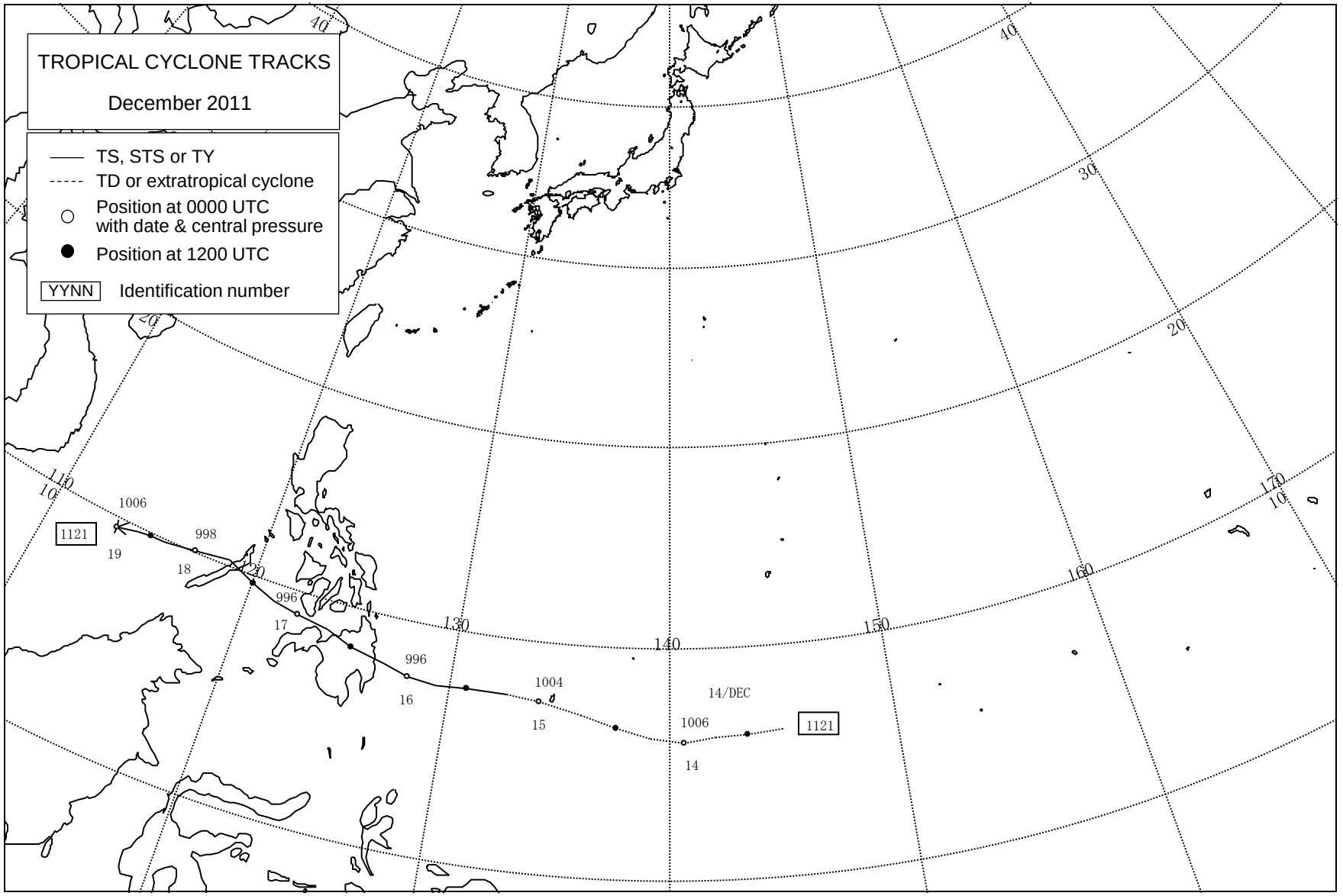

TROPICAL CYCLONE TRACKS
June 2011
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1105
27
990
26
980
1103
11
1000
25
975
1104
992
25
985
24
990
23
22
994
998
1002
21
10
996
20
24
980
09/JUN
09
1006
19
1002
23
985
1103
18
1006
22
998
21/JUN
1002
1008
21
1105
17
17/JUN
1104
110
120
130
140
150
40
30
20
10


TROPICAL CYCLONE TRACKS
July 2011
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1109
1106
1108
1107
14/JUL
25/JUL
27/JUL
12/JUL
50
40
30
20
10
100
110
120
130
140
150
160


TROPICAL CYCLONE TRACKS
August 2011
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
1110
1112
1111
1110
1112
1111
24/AUG
22/AUG
03/AUG
50
40
30
20
10
110
120
130
140
150
160


TROPICAL CYCLONE TRACKS
September 2011
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1113
1115
1116
1114
1117
1119
1118
10
110
120
130
140
150
160
20
30
40
50
24/SEP
07/SEP
10/SEP
15/SEP
27/SEP
02/SEP
23/SEP


TROPICAL CYCLONE TRACKS
October 2011
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
1120
14
1008
1006
13
1006
12
120
130
140
150
1002
11
1006
10
10/0CT
1120


TROPICAL CYCLONE TRACKS
December 2011
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN
Identification number
40
30
20
10
110
120
130
140
150
160
170
1006
1121
998
19
18
20
996
17
996
16
1004
15
14/DEC
1006
14
1121

Appendix 3

Track and Intensity Analysis and Forecast Errors for Each Tropical Cyclone in 2011

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TS Aere (1101)													
May	07/12	0	123	191	349	835		-7	-11	-11	10	15	15
	07/18	31	147	200	296			-7	-11	-11	10	15	15
	08/00	67	75	249	547			-7	-6	-6	10	10	10
	08/06	55	132	291	692			-2	0	2	5	5	0
	08/12	0	203	326	714			-2	2	6	5	0	-35
	08/18	0	118	260				-2	2		5	0	
	09/00	0	90	283				-2	2		5	0	
	09/06	32	151	486				-2	2		5	0	
	09/12	15	204	436				0	6		0	-35	
	09/18	64	121					0			0		
	10/00	22	70					2			0		
	10/06	100	246					2			0		
	10/12	38	251					2			0		
	10/18	31											
	11/00	0											
	11/06	0											
	11/12	0											
	mean	27	148	303	520	835		-2	-2	-4	4	1	1
	sampl	17	13	9	5	1		13	9	5	13	9	5

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Songda (1102)													
May	21/12	22	25					11	0		-15	-5	
	21/18	22	35	142	273	157	220	9	0	-5	-10	0	5
	22/00	11	70	207	284	227	273	-5	-20	-20	5	20	10
	22/06	40	158	333	358	310	369	-5	-15	-10	5	15	5
	22/12	11	133	262	210	200	274	-10	-20	-5	5	15	0
	22/18	0	99	245	112	156	270	-5	-15	5	5	10	-10
	23/00	49	111	214	163	192	222	-15	-15	10	15	10	-15
	23/06	22	109	219	150	211	220	-10	-5	20	10	5	-20
	23/12	40	145	193	99	169	191	-10	5	20	10	-5	-20
	23/18	24	132	92	57	134	441	-10	10	15	10	-15	-20
	24/00	11	74	68	144	215	801	-5	15	15	5	-20	-20
	24/06	25	70	70	186	444		5	25	10	0	-25	-15
	24/12	11	85	63	137	619		15	25	15	-10	-25	-15
	24/18	46	98	91	192	918		25	25	5	-20	-25	-10
	25/00	22	64	154	276	###		20	25	5	-20	-25	-10
	25/06	0	91	172	419			20	5	-5	-15	-5	5
	25/12	16	77	175	483			20	5	-5	-15	0	10
	25/18	0	161	160	558			20	-5	-15	-15	5	10
	26/00	11	111	168	439			15	5	-15	-10	0	10
	26/06	0	77	212				-10	0		5	0	
	26/12	0	46	205				-10	-10		10	10	
	26/18	0	76	332				-15	-20		10	20	
	27/00	0	90	422				-10	-25		5	20	
	27/06	0	170					-10			5		
	27/12	0	170					0			0		
	27/18	11	252					0			0		
	28/00	0	351					-5			10		
	28/06	11											
	28/12	15											
	28/18	0											
	29/00	0											
	mean	14	114	191	252	366	328	1	0	2	-1	-1	-6
	sampl	31	27	22	18	14	10	27	23	18	27	23	18

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TS Sarika (1103)													
Jun.	09/12	44	196					0			0		
	09/18	89	181					-4			5		
	10/00	0	167					-8			10		
	10/06	0											
	10/12	22											
	10/18	11											
	11/00	23											
	mean	27	181					-4			5		
	sampl	7	3					3			3		

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TS Haima (1104)													
Jun.	21/12	44	73	54				2	10		0	-35	
	21/18	21	128	137				4	10		-5	-35	
	22/00	22	69	160				4	15		-5	-40	
	22/06	108	109	133				6	15		-5	-40	
	22/12	69	70	81				8	10		0	-35	
	22/18	0	78					8			0		
	23/00	44	81					13			-5		
	23/06	24	74					13			-5		
	23/12	35	160					10			-35		
	23/18	10											
	24/00	11											
	24/06	0											
	24/12	0											
	mean	30	93	113				8	12		-7	-37	
	sampl	13	9	5				9	5		9	5	

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
STS Meari (1105)													
Jun.	22/00	54	72					9			-10		
	22/06	22	128	283	295	812		5	-5	-15	-5	5	15
	22/12	89	169	229	208	481		-5	-10	-10	5	10	10
	22/18	144	184	278	422	502		-5	-10	-10	5	10	10
	23/00	173	157	263	567	354		0	-10	-10	0	10	10
	23/06	94	178	198	554			0	-10	-5	0	10	5
	23/12	63	80	19	298			5	-10	0	-5	10	0
	23/18	62	56	178	244			0	-10	0	0	10	0
	24/00	57	37	351	183			0	-5	0	0	5	0
	24/06	126	72	354				0	-5		0	5	
	24/12	54	104	246				-10	5		5	-5	
	24/18	91	82	108				0	9		0	-10	
	25/00	70	115	24				0	4		0	-5	
	25/06	0	235					5			-5		
	25/12	81	165					12			-15		
	25/18	0	127					9			-15		
	26/00	0	124					4			-10		
	26/06	0											
	26/12	0											
	26/18	0											
	27/00	78											
	mean	60	123	211	346	537		2	-5	-6	-3	5	6
	sampl	21	17	12	8	4		17	12	8	17	12	8

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Ma-on (1106)													
Jul.	12/00	55	107					11			-15		
	12/06	15	79	159	234	272	102	5	10	5	-5	-5	-5
	12/12	33	98	172	244	226	24	5	5	-5	-5	-5	-5
	12/18	10	103	191	234	181	109	10	0	-10	-5	0	0
	13/00	39	104	212	193	57	119	0	-10	-25	5	0	5
	13/06	15	151	205	175	23	119	-5	-15	-20	10	5	0
	13/12	10	85	154	113	61	153	-10	-20	-20	5	5	5
	13/18	0	56	98	75	130	242	-20	-30	-25	10	10	5
	14/00	10	64	138	219	186	278	-20	-35	-25	5	15	10
	14/06	10	79	167	130	195	245	-20	-25	-30	5	5	20
	14/12	0	91	197	211	298	321	-20	-20	-30	5	5	15
	14/18	0	123	203	233	370	211	-20	-20	-35	5	5	20
	15/00	0	137	191	271	353	200	-20	-20	-30	10	5	15
	15/06	25	94	171	218	200	30	-5	-25	-35	0	15	20
	15/12	25	122	93	142	105	337	-10	-25	-30	5	20	20
	15/18	11	98	46	56	157	638	-20	-30	-30	10	20	20
	16/00	35	91	113	163	33	607	-20	-30	-30	10	20	20
	16/06	11	100	134	149	71	564	-25	-40	-20	20	25	10
	16/12	0	30	132	129	162	607	-20	-35	-15	15	20	10
	16/18	10	64	138	114	277	703	-30	-30	-20	20	20	20
	17/00	10	90	146	114	356	844	-25	-25	-20	20	20	20
	17/06	0	108	87	149	378	765	-35	-20	-10	25	15	10
	17/12	10	118	198	166	395	735	-25	-5	-10	20	5	10
	17/18	10	87	136	202	433	572	-15	-15	-10	10	10	5
	18/00	0	56	159	245	512	549	-15	-25	-15	10	20	10
	18/06	0	30	149	299	470	594	-10	-20	-15	5	20	10
	18/12	15	46	115	211	339	567	-5	-20	-15	0	20	15
	18/18	0	29	156	254	252	483	-5	-10	-15	5	10	15
	19/00	9	67	221	266	456	584	-10	-15	-15	10	15	15
	19/06	22	28	107	269	477	633	-5	-15	-15	5	15	15
	19/12	24	83	206	454	721		-10	-15	-15	10	15	15
	19/18	9	163	328	529	802		-5	-10	-10	5	10	10
	20/00	0	211	472	644	856		-10	-10	-10	10	10	10
	20/06	22	135	390	555	721		-10	-10	-10	10	5	5
	20/12	78	107	232	287			-5	-5	-5	5	5	5
	20/18	77	124	168	273			-5	-5	-5	5	5	5
	21/00	74	200	165	315			-5	-5	-5	5	5	5
	21/06	19	268	351	418			-5	-5	-6	5	5	5
	21/12	68	245	336				-5	-5		5	5	
	21/18	24	158	215				-5	-5		5	5	
	22/00	46	69	72				-5	-5		5	5	
	22/06	24	56	172				-5	-7		5	5	
	22/12	31	37					-5			5		
	22/18	24	38					-5			5		
	23/00	35	108					-5			5		
	23/06	14	155					-7			5		
	23/12	35											
	23/18	95											
	24/00	119											
	24/06	103											
	mean	26	102	183	242	319	411	-10	-16	-17	7	10	11
	sampl	50	46	41	37	33	29	46	41	37	46	41	37

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TS Tokage (1107)													
Jul.	15/06	24											
	15/12	58											
	mean	41											
	sampl	2											

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
STS Nock-ten (1108)													
Jul.	26/00	31	129	84	155	283		6	0	0	-5	0	0
	26/06	0	79	165	200	369		6	0	-5	-5	0	5
	26/12	33	99	190	266	493		4	0	-5	-5	0	5
	26/18	0	109	212	305	579		0	0	-5	0	0	5
	27/00	0	115	188	314			0	-5	-10	0	5	10
	27/06	0	64	182	347			0	-5	-15	0	5	15
	27/12	31	148	262	453			-5	-10	-17	5	10	20
	27/18	31	153	257	498			-5	-10	-19	5	10	25
	28/00	0	176	270				-5	-10		5	10	
	28/06	0	110	267				-5	-15		5	15	
	28/12	53	87	299				0	-12		0	15	
	28/18	74	33	287				0	-9		0	15	
	29/00	0	69					5			-5		
	29/06	84	204					0			0		
	29/12	39	285					-2			5		
	29/18	31	267					0			5		
	30/00	0											
	30/06	31											
	30/12	46											
	30/18	94											
	mean	29	133	222	317	431		0	-6	-9	1	7	11
	sampl	20	16	12	8	4		16	12	8	16	12	8

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Muifa (1109)													
Jul.	28/06	70	187	128	221	315	310	8	30	50	-10	-30	-40
	28/12	79	257	161	324	388	358	5	40	40	-5	-35	-30
	28/18	93	296	179	354	406	308	0	35	25	-5	-25	-20
	29/00	135	313	246	370	445	315	5	25	10	-5	-20	-10
	29/06	179	217	217	335	376	207	15	25	0	-15	-20	-5
	29/12	163	117	263	323	354	200	35	25	0	-30	-20	-5
	29/18	140	126	191	217	228	258	45	25	0	-35	-20	-5
	30/00	54	70	116	158	136	143	40	20	0	-30	-15	-5
	30/06	11	124	124	154	101	185	25	5	0	-15	-5	0
	30/12	0	100	136	246	171	287	-5	-25	-25	0	15	15
	30/18	11	106	166	275	233	418	-5	-20	-15	5	15	10
	31/00	24	137	244	328	225	371	-15	-25	-20	10	15	10
	31/06	11	119	205	213	148	214	-15	-10	-5	10	5	0
	31/12	0	99	167	162	151	210	-15	-10	-5	10	5	0
	31/18	0	56	121	104	166	213	-15	-10	-5	10	5	0
Aug.	01/00	11	83	139	84	142	113	-15	-10	-5	10	5	0
	01/06	10	108	112	119	136	49	0	0	5	0	0	-5
	01/12	0	117	122	121	151	147	0	0	5	0	0	-5
	01/18	11	107	72	107	146	124	0	0	5	0	0	-5
	02/00	10	84	24	73	70	298	0	0	5	0	0	-5
	02/06	10	46	30	87	112	428	0	0	5	0	0	-5
	02/12	0	52	46	101	213	533	0	0	0	0	0	0
	02/18	0	102	151	209	343	525	0	0	0	0	0	0
	03/00	0	42	121	226	457	626	0	0	0	0	0	0
	03/06	10	75	129	273	548	678	0	0	-5	0	0	5
	03/12	0	55	127	292	531	748	0	-5	-10	0	5	10
	03/18	0	64	100	310	568	921	0	-5	-10	0	5	10
	04/00	0	67	133	331	586		0	-10	-10	0	10	5
	04/06	15	75	184	441	694		0	-15	-10	0	15	10
	04/12	10	75	228	512	825		-5	-20	-5	5	20	5
	04/18	10	100	307	488	775		-5	-20	-5	5	20	5
	05/00	20	108	320	395			-10	-20	-10	10	15	5
	05/06	0	83	239	373			-15	-25	-15	15	20	10
	05/12	0	66	234	472			-15	-20	-15	15	15	20
	05/18	0	112	219	577			-15	-20	-12	15	15	20
	06/00	74	115	273				-10	-10		10	10	
	06/06	15	86	289				-5	-5		5	5	
	06/12	22	93	251				0	0		-5	5	
	06/18	22	62	297				-5	0		0	5	
	07/00	30	83					0			-5		
	07/06	14	115					-5			0		
	07/12	18	159					0			5		
	07/18	18	153					2			5		
	08/00	21											
	08/06	24											
	08/12	25											
	08/18	40											
	mean	30	112	175	268	327	340	0	-1	-1	0	1	0
	sampl	47	43	39	35	31	27	43	39	35	43	39	35

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
STS Merbok (1110)													
Aug.	03/06	47	81	177	122	157	291	-8	-5	-5	10	5	5
	03/12	59	52	87	67	89	69	-8	-5	-5	10	5	5
	03/18	15	75	162	202	306	178	-8	-5	-5	10	5	5
	04/00	15	114	273	445	556	523	-4	0	-5	5	0	5
	04/06	0	69	200	265	263	405	0	0	-5	0	0	5
	04/12	0	33	74	168	245	303	0	0	-5	0	0	5
	04/18	23	83	190	318	599		0	-5	-5	0	5	10
	05/00	98	131	330	559	825		0	-5	-5	0	5	10
	05/06	11	49	257	518	701		-5	-10	0	5	10	5
	05/12	11	40	238	490	519		-5	-10	0	5	10	5
	05/18	0	92	280	532			-10	-5	0	10	10	5
	06/00	0	80	159	413			-10	-5	0	10	10	5
	06/06	15	82	262	345			-10	-5	0	10	10	5
	06/12	0	93	247	189			-10	0	5	10	5	0
	06/18	11	59	261				-5	0		10	5	
	07/00	15	43	116				0	5		5	0	
	07/06	49	35	125				0	0		5	5	
	07/12	38	96	51				5	5		0	0	
	07/18	0	147					10			-5		
	08/00	22	161					10			-5		
	08/06	0	40					5			0		
	08/12	9	83					5			0		
	08/18	28											
	09/00	0											
	09/06	24											
	09/12	0											
	mean	19	79	194	331	426	295	-2	-3	-2	4	5	5
	sampl	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	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Nanmadol (1111)													
Aug.	23/12	44	132	321	440	615	703	5	25	45	-10	-25	-35
	23/18	46	177	400	493	622	641	5	35	30	-10	-30	-25
	24/00	21	210	398	551	611	709	5	45	15	-10	-35	-15
	24/06	0	216	380	537	582	703	10	45	10	-15	-35	-10
	24/12	31	225	325	350	364	510	20	40	0	-20	-30	-5
	24/18	43	197	253	316	320	510	35	30	-15	-30	-25	5
	25/00	0	173	305	327	423	539	35	5	-30	-25	-10	15
	25/06	0	155	324	347	441	499	25	-5	-35	-15	0	25
	25/12	0	110	270	331	451	496	20	-15	-40	-15	10	30
	25/18	0	69	180	176	338	414	5	-35	-45	0	25	35
	26/00	0	101	160	281	351		-20	-50	-55	5	30	40
	26/06	0	91	106	251	370		-35	-60	-60	20	40	45
	26/12	0	84	123	253	366		-35	-55	-60	25	40	45
	26/18	0	84	98	238	315		-45	-50	-52	30	35	40
	27/00	0	61	189	247			-45	-55	-52	35	45	40
	27/06	21	68	192	254			-30	-40	-37	25	35	40
	27/12	22	84	210	263			-15	-15	-7	10	10	10
	27/18	0	52	195	263			-10	-7	-4	10	5	10
	28/00	30	89	186				-5	-2		0	0	
	28/06	30	114	105				-5	-2		0	5	
	28/12	22	33	52				0	0		0	5	
	28/18	22	20	33				-2	-2		5	10	
	29/00	39	30					0			0		
	29/06	38	46					2			5		
	29/12	38	32					4			0		
	29/18	23	52					2			0		
	30/00	30											
	30/06	0											
	30/12	15											
	30/18	15											
	mean	18	104	218	329	441	572	-3	-8	-22	1	5	16
	sampl	30	26	22	18	14	10	26	22	18	26	22	18

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
STS Talas (1112)													
Aug.	25/00	108	101	136	68	118	141	0	-5	-10	5	15	20
	25/06	46	39	113	224	368	402	-5	-15	-20	10	25	25
	25/12	54	10	59	193	335	354	-5	-10	-20	10	20	25
	25/18	86	10	78	132	150	214	0	-10	-20	10	20	25
	26/00	137	43	105	200	141	237	-10	-20	-25	20	25	30
	26/06	119	51	112	190	83	241	-15	-25	-30	25	30	30
	26/12	43	113	202	309	245	530	-15	-30	-30	25	30	35
	26/18	49	167	229	258	262	636	-15	-30	-30	25	30	35
	27/00	44	111	161	151	326	627	-15	-30	-30	25	30	35
	27/06	33	67	75	35	286	580	-10	-20	-20	20	25	30
	27/12	24	52	51	32	284	544	-10	-15	-20	20	25	30
	27/18	24	62	82	82	308	527	-5	-10	-10	15	25	25
	28/00	10	61	97	73	322	533	-5	-10	-10	15	25	25
	28/06	24	70	126	80	295	487	-5	-10	-10	15	25	25
	28/12	68	84	60	145	400	685	0	-10	-10	10	20	20
	28/18	10	0	67	349	614	840	0	-10	-10	10	20	20
	29/00	0	11	107	392	654	###	0	-10	-10	10	20	20
	29/06	0	46	104	331	713	###	0	-10	-10	10	20	20
	29/12	0	11	136	408	790	###	-5	-10	-10	15	20	20
	29/18	0	45	169	479	956	###	-10	-10	-10	20	20	20
	30/00	0	81	221	513	###	###	-10	-10	-10	20	20	20
	30/06	0	78	198	446	###	###	-10	-10	-5	20	20	15
	30/12	0	74	224	379	###	###	-10	-10	-5	20	20	15
	30/18	15	74	195	359	843	###	-10	-10	-10	20	20	15
	31/00	23	45	120	222	684	###	-10	-10	-17	20	20	15
	31/06	0	30	98	247	822		-5	-5	-10	15	15	5
	31/12	0	29	69	595	###		-5	-5	-5	15	15	5
	31/18	0	44	120	680	###		-5	-5	-2	15	10	0
Sep.	01/00	23	59	74	509	987		-5	-12	-4	15	10	5
	01/06	11	22	134	558			-5	0	-4	15	0	5
	01/12	0	22	173	689			-5	-5	-4	15	5	5
	01/18	15	43	220	802			-5	-2	-4	10	0	5
	02/00	0	120	415	890			-2	-9	0	5	10	0
	02/06	9	223	689				0	-9		0	10	
	02/12	11	224	627				-5	-9		5	10	
	02/18	0	169	654				-7	-9		5	10	
	03/00	0	181	569				-9	-4		10	5	
	03/06	24	267					-9			10		
	03/12	9	256					-4			10		
	03/18	22	356					-2			5		
	04/00	11	272					-2			5		
	04/06	21											
	04/12	14											
	04/18	0											
	05/00	143											
	mean	27	93	191	334	576	847	-6	-11	-13	14	18	19
	sampl	45	41	37	33	29	25	41	37	33	41	37	33

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TS Noru (1113)													
Sep.	03/12	41	297					4			-5		
	03/18	122	152					6			-5		
	04/00	46	380					6	2		-5	5	
	04/06	10	110	82				0	0		5	5	
	04/12	40	92					0			5		
	04/18	35	56					0			5		
	05/00	9	38					4			0		
	05/06	0	100					4			0		
	05/12	18											
	05/18	9											
	06/00	0											
	06/06	0											
	mean	27	153	82				3	1		0	5	
	sampl	12	8	1				8	2		8	2	

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TS Kulap (1114)													
Sep.	07/06	33	293					-4			5		
	07/12	64	316					-6			5		
	07/18	0	238					-4			0		
	08/00	0											
	08/06	0											
	08/12	0											
	08/18	0											
	mean	14	283					-5			3		
	sampl	7	3					3			3		

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Roke (1115)													
Sep.	13/06	204	301					-2			5		
	13/12	168	151	90	35	335	308	0	0	5	5	5	0
	13/18	88	87	83	188	413	338	0	0	0	5	5	5
	14/00	44	153	161	295	430	411	0	0	0	10	5	5
	14/06	0	135	126	307	336	285	2	5	5	5	0	0
	14/12	33	156	136	331	292	333	2	5	5	5	0	-5
	14/18	45	113	170	342	293	383	2	5	10	5	0	-10
	15/00	75	78	212	346	318	557	2	5	10	0	0	-10
	15/06	22	39	240	277	316	632	5	5	5	-5	-5	-10
	15/12	15	78	267	223	269	722	0	0	5	0	-5	-10
	15/18	0	67	224	220	371	966	0	5	5	0	-10	-10
	16/00	0	115	251	245	511	###	0	5	0	0	-10	-5
	16/06	0	132	220	319	619	###	5	5	0	-5	-10	-5
	16/12	22	195	221	355	734	###	5	5	5	-10	-10	-10
	16/18	0	158	187	311	745	###	10	5	10	-15	-10	-15
	17/00	22	215	207	350	680	###	10	5	15	-15	-10	-20
	17/06	0	173	231	354	639		5	0	25	-10	-5	-25
	17/12	0	156	187	293	610		5	5	35	-10	-10	-30
	17/18	0	137	155	327	886		0	10	35	-5	-15	-30
	18/00	11	143	265	465	940		0	15	25	0	-15	-25
	18/06	24	136	191	496			0	25	20	0	-20	-20
	18/12	0	33	31	149			0	30	10	-5	-25	-15
	18/18	30	90	214	537			5	30	10	-5	-20	-15
	19/00	10	110	273	595			10	20	5	-10	-15	-10
	19/06	0	78	307				20	15		-15	-10	
	19/12	0	182	161				30	5		-20	-10	
	19/18	0	188	273				30	5		-20	-10	
	20/00	0	129	244				10	0		-5	-5	
	20/06	0	89					10			-5		
	20/12	0	141					0			0		
	20/18	0	94					5			-5		
	21/00	0	127					0			-5		
	21/06	0											
	21/12	0											
	21/18	17											
	22/00	71											
	mean	25	131	197	320	513	845	5	8	11	-4	-8	-12
	sampl	36	32	27	23	19	15	32	27	23	32	27	23

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Sonca (1116)													
Sep.	15/06	11	273	234	165	347	37	2	8	23	-5	-10	-25
	15/12	73	186	178	172	266		2	13	23	-5	-15	-25
	15/18	23	101	199	345	406		0	13	23	-5	-15	-25
	16/00	22	51	56	85	367		4	18	28	-5	-20	-30
	16/06	11	11	22	169	558		10	23	28	-10	-25	-30
	16/12	11	100	101	37			13	23	28	-15	-25	-30
	16/18	0	15	48	165			13	23	28	-15	-25	-30
	17/00	15	59	67	174			16	26	17	-15	-25	-25
	17/06	10	134	114	274			15	24	14	-15	-25	-20
	17/12	10	115	107				10	20		-10	-20	
	17/18	0	93	77				10	24		-10	-25	
	18/00	0	101	155				20	19		-20	-20	
	18/06	0	64	210				15	12		-15	-15	
	18/12	0	107					15			-15		
	18/18	0	88					15			-20		
	19/00	0	89					10			-15		
	19/06	0	167					5			-10		
	19/12	0											
	19/18	0											
	20/00	11											
	20/06	0											
	mean	9	103	121	176	389	37	10	19	24	-12	-20	-27
	sampl	21	17	13	9	5	1	17	13	9	17	13	9

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Nesat (1117)													
Sep.	24/00	25	291	344	384	608	639	7	20	15	-5	-20	-15
	24/06	21	295	361	510	638	754	5	15	0	-5	-15	0
	24/12	11	208	271	436	600	834	5	20	0	-5	-20	0
	24/18	57	144	164	261	414	635	10	25	0	-10	-20	0
	25/00	46	81	123	206	210	385	5	5	-5	-5	-5	5
	25/06	15	35	69	75	279	369	0	5	-5	0	-5	5
	25/12	22	68	132	216	356	395	0	5	-5	0	-5	5
	25/18	25	39	152	215	364		5	0	-10	0	0	10
	26/00	15	48	152	252	397		5	-5	-10	-5	5	10
	26/06	11	54	98	294	378		-5	-5	-10	5	5	10
	26/12	0	31	140	298	329		0	-5	-5	0	5	5
	26/18	0	63	161	293			-5	-5	-15	5	5	15
	27/00	11	78	183	277			-5	-15	-20	5	10	20
	27/06	15	55	210	298			-10	-15	-22	5	10	20
	27/12	25	53	228	241			-10	-15	-28	5	10	30
	27/18	25	55	175				-15	-15		10	15	
	28/00	25	143	177				-15	-15		10	15	
	28/06	15	115	179				-15	-17		10	15	
	28/12	34	71	53				-5	-8		5	10	
	28/18	11	46					-10			10		
	29/00	15	53					-5			5		
	29/06	24	35					-2			0		
	29/12	38	53					0			0		
	29/18	11											
	30/00	15											
	30/06	24											
	30/12	11											
	mean	20	92	178	284	416	573	-3	-1	-8	2	1	8
	sampl	27	23	19	15	11	7	23	19	15	23	19	15

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TS Haitang (1118)													
Sep.	25/00	54	64					-4			10		
	25/06	22	31					-6			10		
	25/12	0	119					-6			10		
	25/18	22											
	26/00	0											
	26/06	35											
	26/12	15											
	mean	21	71					-5			10		
	sampl	7	3					3			3		

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Nalgae (1119)													
Sep.	27/18	42	134	273	474	675	524	13	34	50	-20	-40	-45
	28/00	0	133	254	494	601	486	12	30	40	-15	-30	-35
	28/06	0	119	234	456	509	348	5	25	20	-10	-25	-20
	28/12	22	140	296	468	373	140	15	35	5	-20	-30	-10
	28/18	0	129	357	403	258	93	15	30	5	-20	-25	-5
	29/00	22	64	221	285	124	61	20	35	0	-20	-30	0
	29/06	44	64	242	234	74	74	25	20	-5	-25	-20	5
	29/12	61	64	232	162	92	193	25	5	-10	-20	-10	10
	29/18	22	84	178	91	67		5	-5	-25	0	5	25
	30/00	0	131	193	94	77		10	-10	-25	-5	10	25
	30/06	11	113	105	108	116		0	-15	-25	-5	15	25
	30/12	11	91	67	155	84		-10	-30	-35	0	25	30
	30/18	22	60	39	101			-10	-35	-40	5	30	35
Oct.	01/00	0	54	79	101			-20	-35	-42	15	30	35
	01/06	54	43	119	179			-25	-35	-46	20	30	40
	01/12	32	62	91	203			-25	-30	-45	20	25	40
	01/18	0	79	74				-25	-30		25	30	
	02/00	43	99	123				-25	-32		25	30	
	02/06	32	119	199				-10	-21		10	20	
	02/12	21	94	244				-5	-20		5	20	
	02/18	21	96					-5			5		
	03/00	40	85					-7			5		
	03/06	21	111					-11			10		
	03/12	21	96					-10			10		
	03/18	74											
	04/00	42											
	04/06	22											
	04/12	15											
	mean	25	94	181	251	254	240	-2	-4	-11	0	3	10
	sampl	28	24	20	16	12	8	24	20	16	24	20	16

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
TY Banyan (1120)													
Oct.	10/18	110											
	11/00	143											
	mean	127											
	sampl	2											

Date/Time		Center Position (km)						Central Pressure (hPa)			Max. Wind (kt)		
	(UTC)	T=00	=24	=48	=72	=90	=120	T=24	=48	=72	T=24	=48	=72
STS Washi (1121)													
Dec.	15/06	35	190	173	245			0	2	-2	-5	-5	0
	15/12	22	124	16	99			-2	2	-4	0	-5	0
	15/18	11	22	102	86			-2	2	-2	0	0	0
	16/00	0	35	120				4	2		-5	0	
	16/06	0	46	159				4	-2		-5	5	
	16/12	22	84	109				4	-4		-5	5	
	16/18	40	156	123				0	-4		5	5	
	17/00	16	140					-4			10		
	17/06	35	102					-6			10		
	17/12	64	98					-6			5		
	17/18	69	16					-6			5		
	18/00	80											
	18/06	46											
	18/12	40											
	18/18	11											
	mean	33	92	115	143			-1	0	-3	1	1	0
	sampl	15	11	7	3			11	7	3	11	7	3

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 - 2011

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
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 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
96HF YYGGgg$_F$ UTC LaLa.La$_F$ N LoLoLo.Lo$_F$ E (or W) FrFrFr NM 70%
MOVE direction SpSpSp KT
120HF YYGGgg$_F$ UTC LaLa.La$_F$ N LoLoLo.Lo$_F$ 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. GSM (TL959L60) has about 20 km horizontal resolution and 60 vertical layers. Details on the GSM are found in Nakagawa (2009). 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 general specifications of GSM and TEPS are summarized in Table 6.1.

Table 6.1 Specifications of GSM and TEPS

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

[Recent upgrades on the Global Data Assimilation System]

- A revised QC system for polar AMVs was introduced (February 2011)
- A revised 4D-Var data assimilation system was introduced to enhance the inner model's resolution from T159L60 to TL319L60 (October 2011)

TEPS:

TEPS is an ensemble prediction system used mainly for TC track forecasts up to five days ahead. Initial perturbations are produced by the combination of two types of SV calculation. One produces the dry SVs whose spatial target area is fixed as the Northwestern Pacific (20°N -60°N, 100°E-180°), and the other produces moist SVs whose spatial target area is movable as it is within a 750-km-radius of the predicted TC's position in one-day forecasting. Up to three movable areas

can be configured for different TCs at one initial time. When more than three TCs are present in the responsibility area, three of them are selected in the order of concern of 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. The details on TEPS are found in Yamaguchi and Komori (2009).

[References]

Nakagawa, M., 2009: Outline of the High Resolution Global Model at the Japan Meteorological Agency. RSMC Tokyo-Typhoon Center Technical Review, **11**, 1-13.

Yamaguchi, M. and T. Komori, 2009: Outline of the Typhoon Ensemble Prediction System at the Japan Meteorological Agency. RSMC Tokyo-Typhoon Center Technical Review, **11**, 14-24.

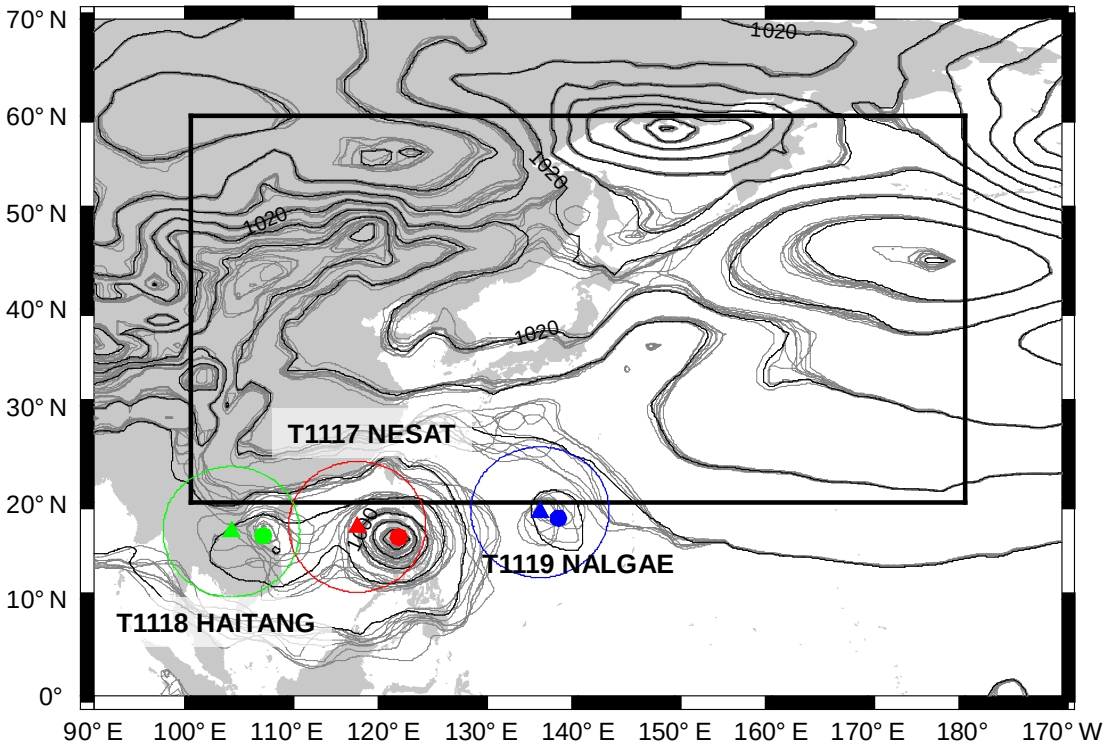


Figure 6.1 Example of SV spatial target areas of TEPS (Initial time: 00UTC 27 September 2011). The large thick rectangle shows the fixed area and the circles show the three movable areas which are set around the predicted TCs' central positions. Filled circles and triangles show TCs' central positions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

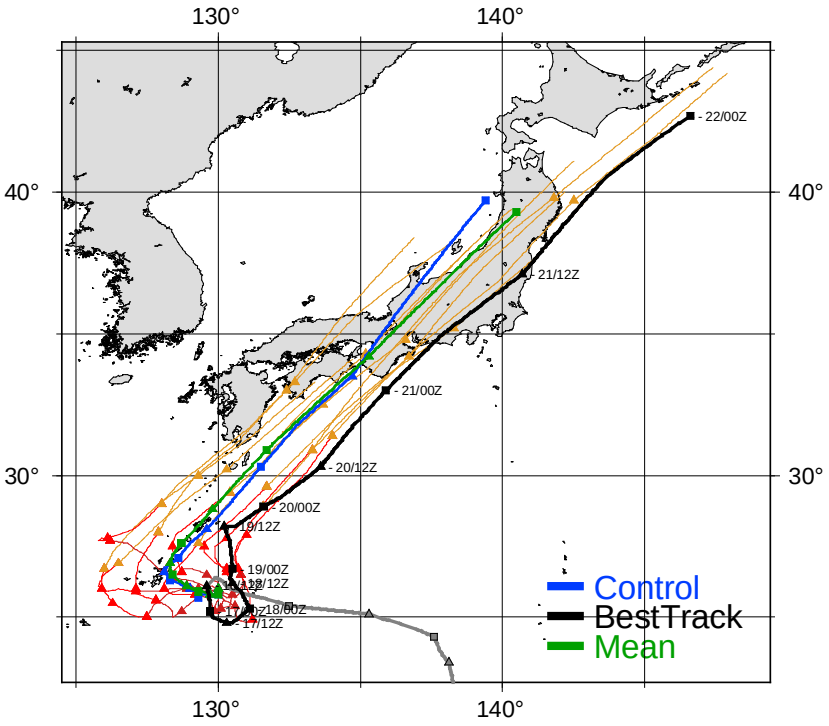


Figure 6.2 Example of TEPS forecast track (Initial time: 12UTC 16 September 2011). Black, blue, and green lines denote TC best track, forecast track of control member and ensemble mean respectively. Red (up to 96-hour) and yellow (up to 120-hour) lines show TC forecast tracks of all perturbed members.

Appendix 7

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

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

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

Model	GSM	Mid-range EPS
Area and resolution	20°S–60°N, 80°E–200°E 2.5°×2.5° (to be terminated in March 2012)	Whole globe, 2.5°×2.5°
Levels and elements	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 500 hPa: Z, U, V, T, D, ζ 700 hPa: Z, U, V, T, D, ω 850 hPa: Z, U, V, T, D, ω Surface: P, U, V, T, D, R	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	0–36 (every 6 hours), 48, 60, and 72	0–192 (every 12 hours)
Initial times	00UTC and 12UTC	12UTC

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

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

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

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

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

Appendix 8

User's Guide to the Attached DVD

Preface

This DVD contains all the texts, tables and charts of the RSMC Annual Report 2011 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 2011. This document is a brief user's guide to 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 2011 in PDF)
        |---Figure (figures for MS PowerPoint)
        |---Table (tables for MS PowerPoint)
        |---Appendix (appendices for MS Word, Excel and PowerPoint)
|------Programs
        |---Gmslpd
            |--Gmslpd.exe (viewer; tropical cyclone version in English)
            |--Gsetup.exe (setup programs)
|------Satellite_Image_Data
        |---T1101 (hourly satellite image data)
        |---T1102 (hourly satellite image data)
                :
        |---T1121 (hourly satellite image data)
|------Andata
        |--Besttrack
            |--E_BST_2011.txt (best track data for 2011)
            |--E_BST_201105.txt (best track data for TCs generated in May 2011)
                        :
            |--E_BST_201112.txt (best track data for TCs generated in December 2011)
```

How to use the DVD

When the DVD runs, a start menu automatically appears displaying a panel with buttons marked *Annual Report 2011*, *MTSAT Satellite Image*, *About DVD* and *Close* as well as a file list box for a number of 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 2011 >

Annual Report 2011 is provided in two formats as PDF files and MS Word/Excel/PowerPoint files.

- PDF files:

Click the *Annual Report 2011* 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/PowerPoint files:

The original figures and tables prepared with Microsoft Word, Excel or PowerPoint 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 2011 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 generation stage to the weakening stage of each tropical cyclone

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:

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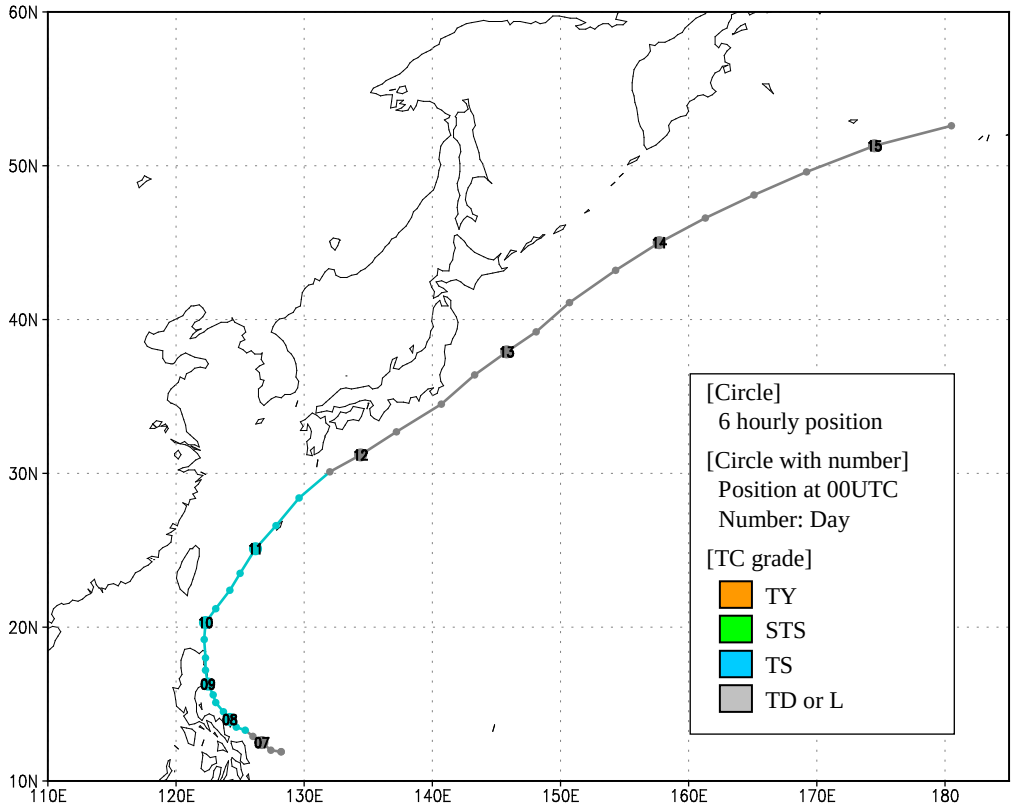
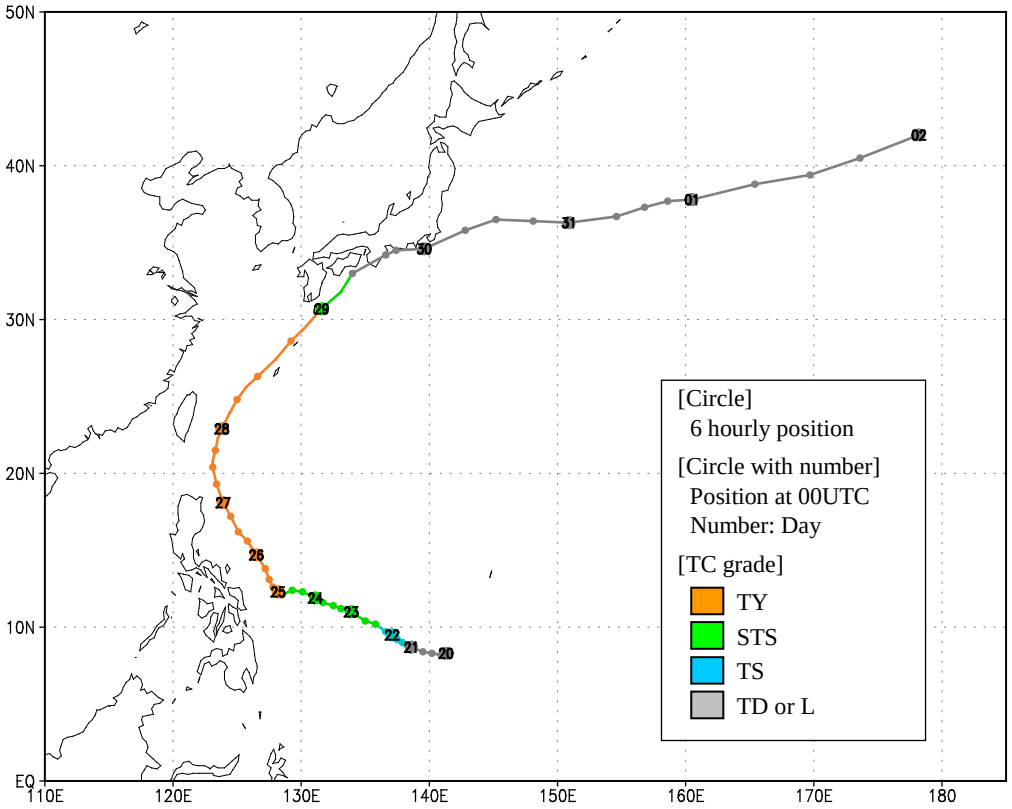
AERE (1101)

Aere formed as a tropical depression (TD) east of Samar Island in the Philippines at 12 UTC on 6 May 2011. Moving northwestward, it was upgraded to tropical storm (TS) intensity at 12 UTC on 7 May and reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 992 hPa east of Luzon Island 24 hours later. After moving along the northeastern coast of Luzon Island, Aere turned northeastward and moved along the Okinawa Islands before weakening to TD intensity south of Kyushu Island at 18 UTC on 11 May. It continued moving northeastward south of the Japanese Island. Aere transformed into an extratropical cyclone east of Honshu Island at 18 UTC on 12 May and crossed longitude 180 degrees east near the Aleutian Islands before 06 UTC on 15 May.



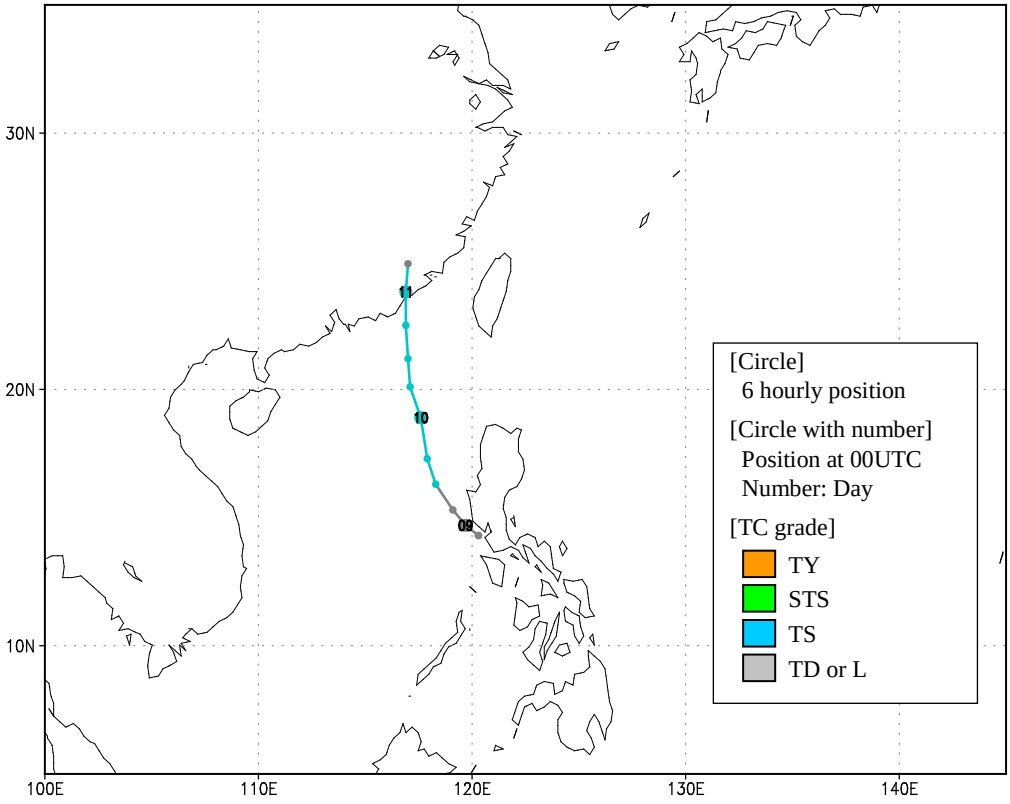
SONGDA (1102)

Songda formed as a tropical depression (TD) east of the Yap Islands at 18 UTC on 19 May 2011. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity just south of the Yap Islands at 12 UTC on 21 May. Soon after being upgraded to typhoon (TY) intensity east of the Philippines at 18 UTC on 24 May, Songda turned northwestward and reached its peak intensity with maximum sustained winds of 105 kt and a central pressure of 920 hPa east of Luzon Island at 06 UTC on 26 May. Gradually turning northeastward, it moved along the Okinawa Islands before transforming into an extratropical cyclone at 06 UTC on 29 May south of Shikoku Island. Songda continued moving east-northeastward until it dissipated four days later near the dateline.



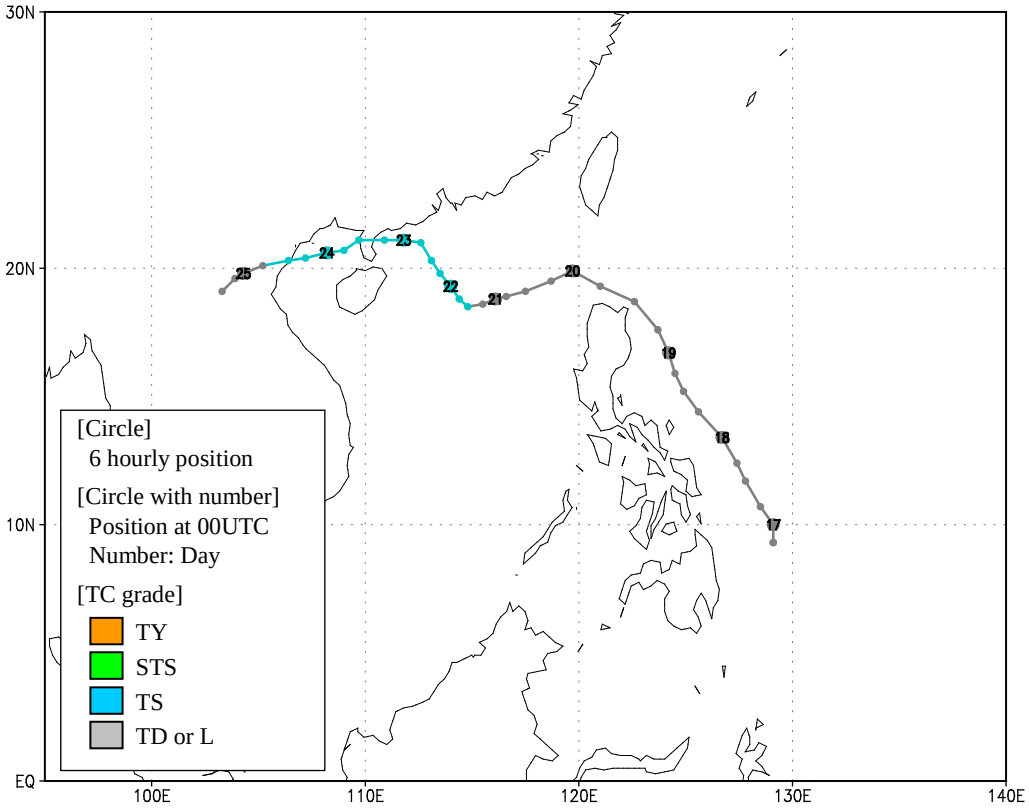
SARIKA (1103)

Sarika formed as a tropical depression (TD) near the western coast of Luzon Island at 18 UTC on 8 June 2011. Moving northwestward, it was upgraded to tropical storm (TS) intensity west of Luzon Island at 12 UTC the next day. Gradually turning northward, Sarika reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 996 hPa over the South China Sea at 00 UTC on 10 June. Keeping its northward track, it hit southern China before 00UTC on 11 June. Sarika weakened to TD intensity at 06 UTC that day and dissipated six hours later.



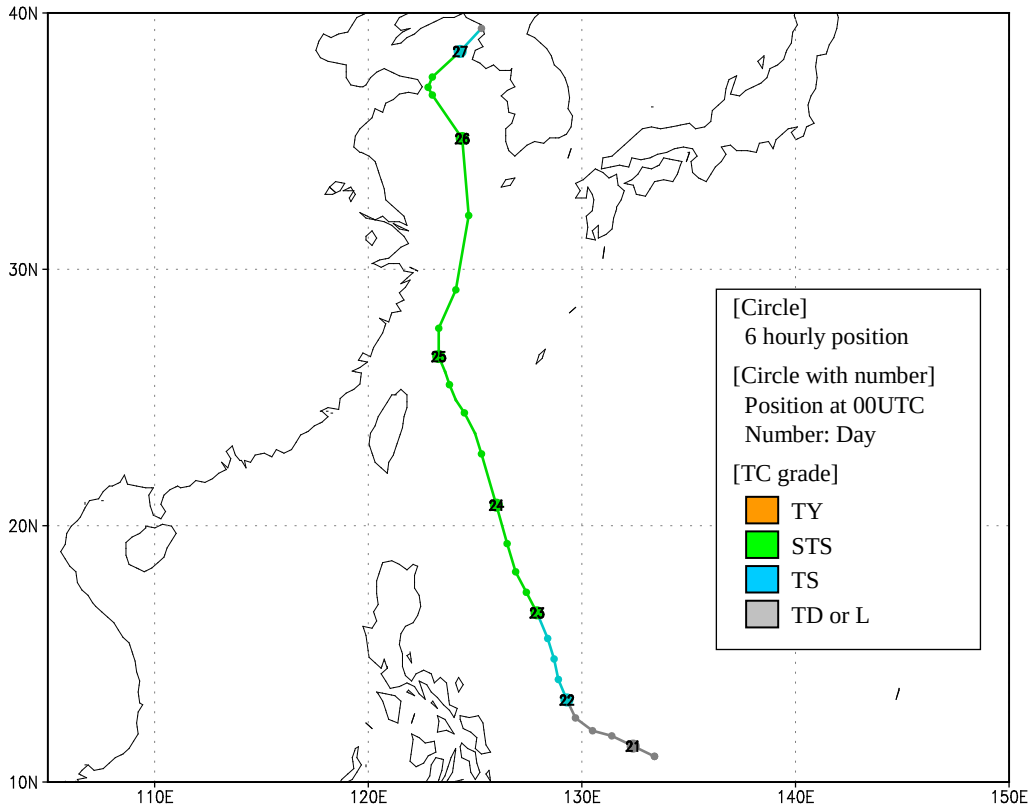
HAIMA (1104)

Haima formed as a tropical depression (TD) east of Mindanao Island at 18 UTC on 16 June 2011. It moved northwestward east of Luzon Island and turned westward crossing the Luzon Strait. Moving westward over the South China Sea, it was upgraded to tropical storm (TS) intensity at 12 UTC on 21 June. Moving northwestward then westward off the southern coast of China, Haima passed the Leizhou Peninsula and entered the Gulf of Tonkin where it reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 985 hPa at 00 UTC on 24 June. Continuing westward, Haima weakened to TD intensity at 18 UTC on the same day over Viet Nam and dissipated around Laos 24 hours later.



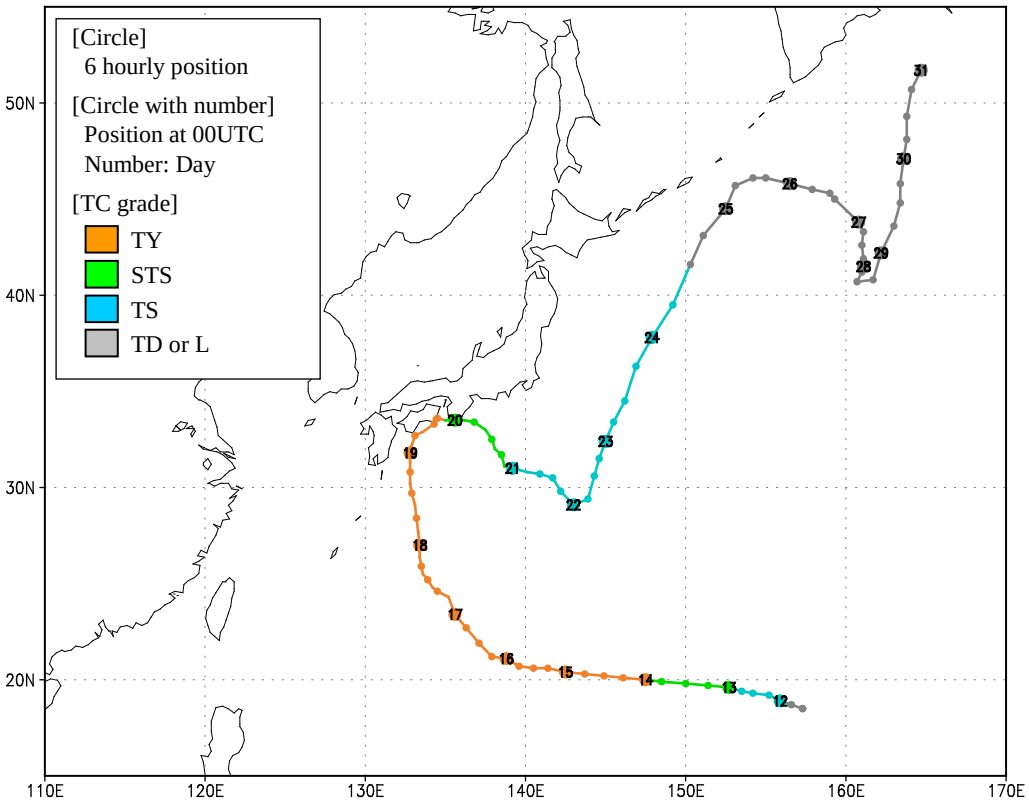
MEARI (1105)

Meari formed as a tropical depression (TD) north of the Palau Islands at 18 UTC on 20 June 2011. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity east of Samar Island in the Philippines at 00 UTC on 22 June. After turning north-northwestward, Meari was further upgraded to severe tropical storm (STS) intensity east of Luzon Island 24 hours later. Keeping its north-northwestward track and gradually accelerating, Meari reached its peak intensity with maximum sustained winds of 60 kt and a central pressure of 975 hPa south of the Sakishima Islands at 09 UTC on 24 June. After moving northward over the East China Sea, it turned sharply northeastward near the Shandong Peninsula and was downgraded to TS intensity over the Yellow Sea at 00 UTC on 27 June. Meari transformed into an extratropical cyclone off the northwestern coast of the Korean Peninsula at 06 UTC on 27 June and dissipated six hours later.



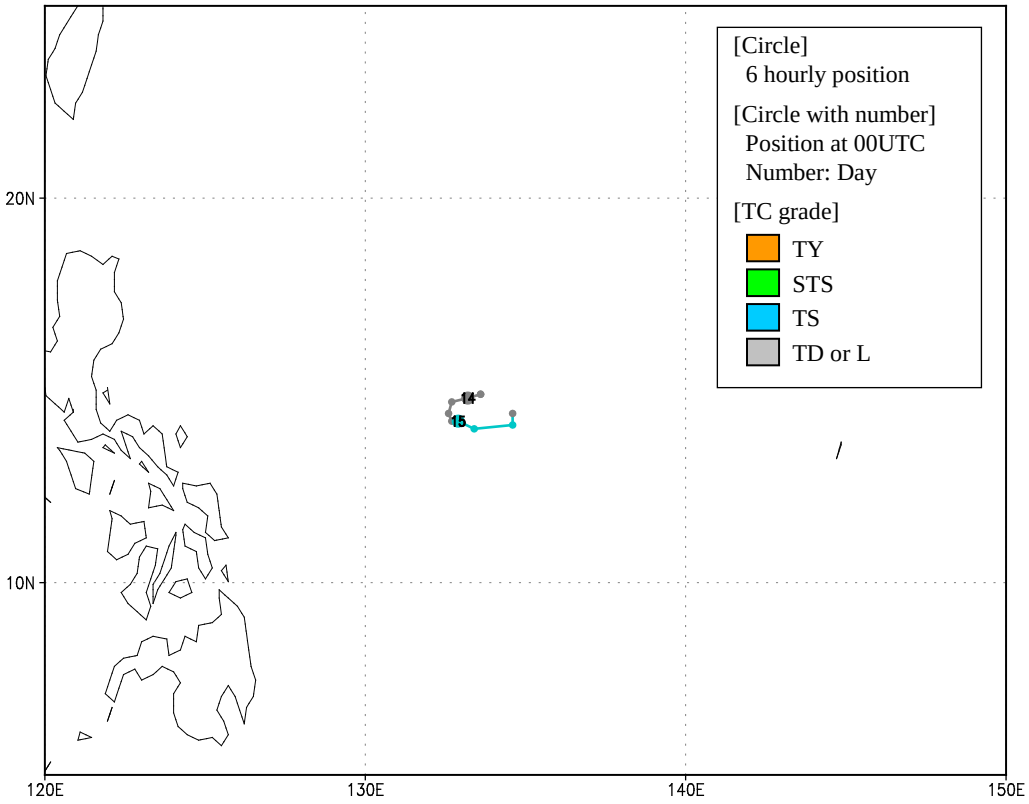
MA-ON (1106)

Ma-on formed as a tropical depression (TD) southeast of Marcus Island at 12 UTC on 11 July 2011. Keeping its westward track, it was upgraded to tropical storm (TS) intensity at 00 UTC the next day before being further upgraded to typhoon (TY) intensity northeast of the Mariana Islands at 00 UTC on 14 July. Soon after turning northwestward, Ma-on reached its peak intensity with maximum sustained winds of 95 kt and a central pressure of 935 hPa northeast of Okinotorishima Island at 12 UTC on 16 July. It turned northward late on 17 July and made landfall on Shikoku Island with TY intensity at around 14 UTC on 19 July. A few hours later, Ma-on moved eastward and passed around Shionomisaki with severe tropical storm (STS) intensity before 01 UTC the next day. It moved south-eastward until early on 22 July before turning north-northeastward. Ma-on transformed into an extratropical cyclone east of Hokkaido Island at 12 UTC on 24 July and dissipated east of the Kamchatka Peninsula at 00 UTC on 31 July.



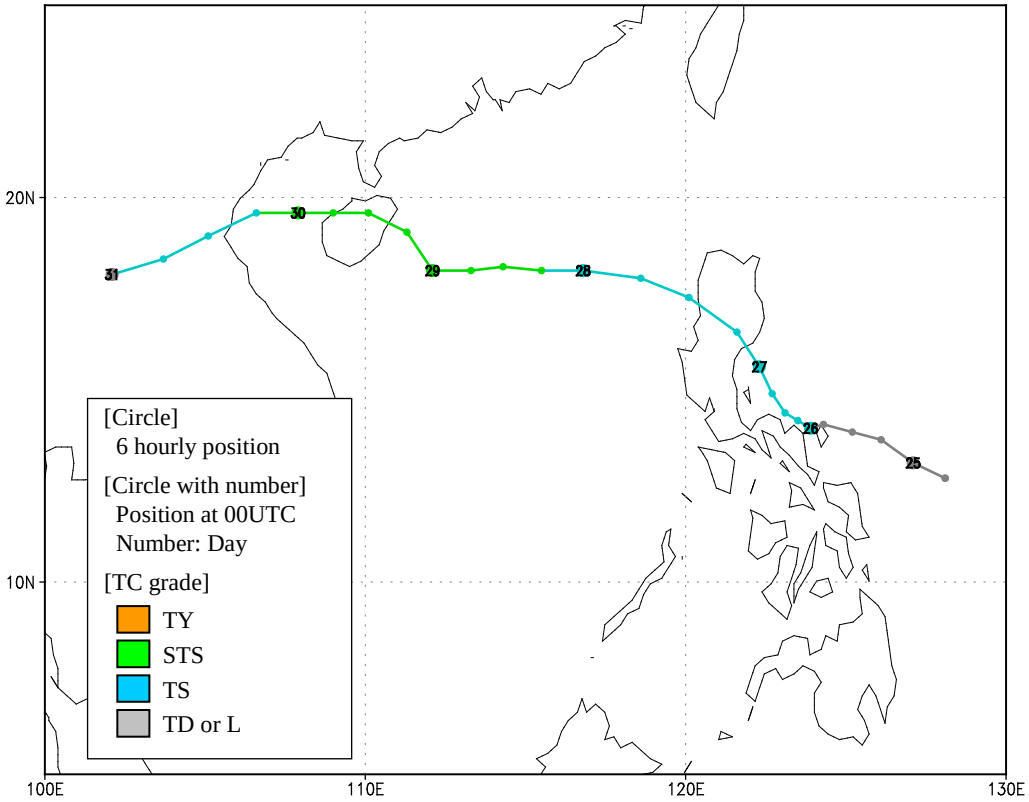
TOKAGE (1107)

Tokage formed as a tropical depression (TD) far east of the Philippines at 18 UTC on 13 July 2011. Moving over a small circle in a counterclockwise starting westward, it was upgraded to tropical storm (TS) intensity at 00 UTC on 15 July when it reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 1000 hPa. Tokage soon weakend to TD intensity 18 hours later and dissipated six more hours later.



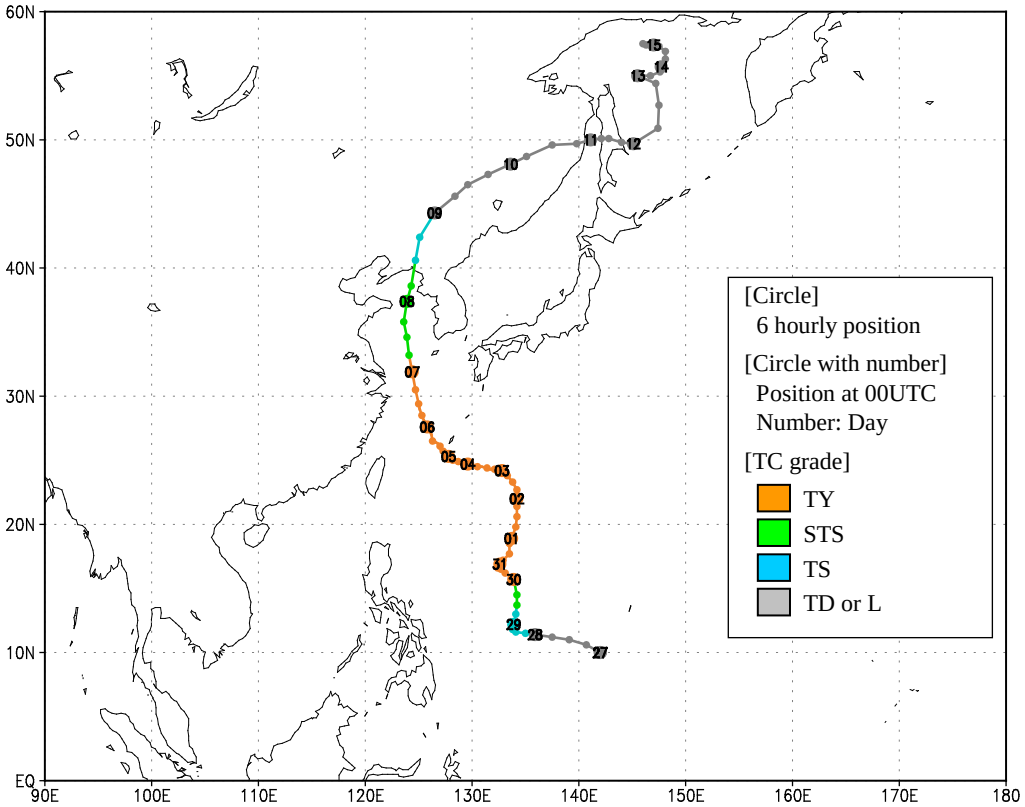
NOCK-TEN (1108)

Nock-ten formed as a tropical depression (TD) east of Samar Island in the Philippines at 18 UTC on 24 July 2011. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity near the southeastern coast of Luzon Island at 00 UTC on 26 July. After crossing Luzon Island, Nock-ten 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 South China Sea at 06 UTC on 28 July. Moving westward over the same waters, it crossed Hainan Island and entered the Gulf of Tonkin where it was downgraded to TS intensity at 06 UTC on 30 July. Turning west-southwestward, Nock-ten weakened to TD intensity near the border between Laos and Thailand at 00 UTC on 31 July and dissipated six hours later.



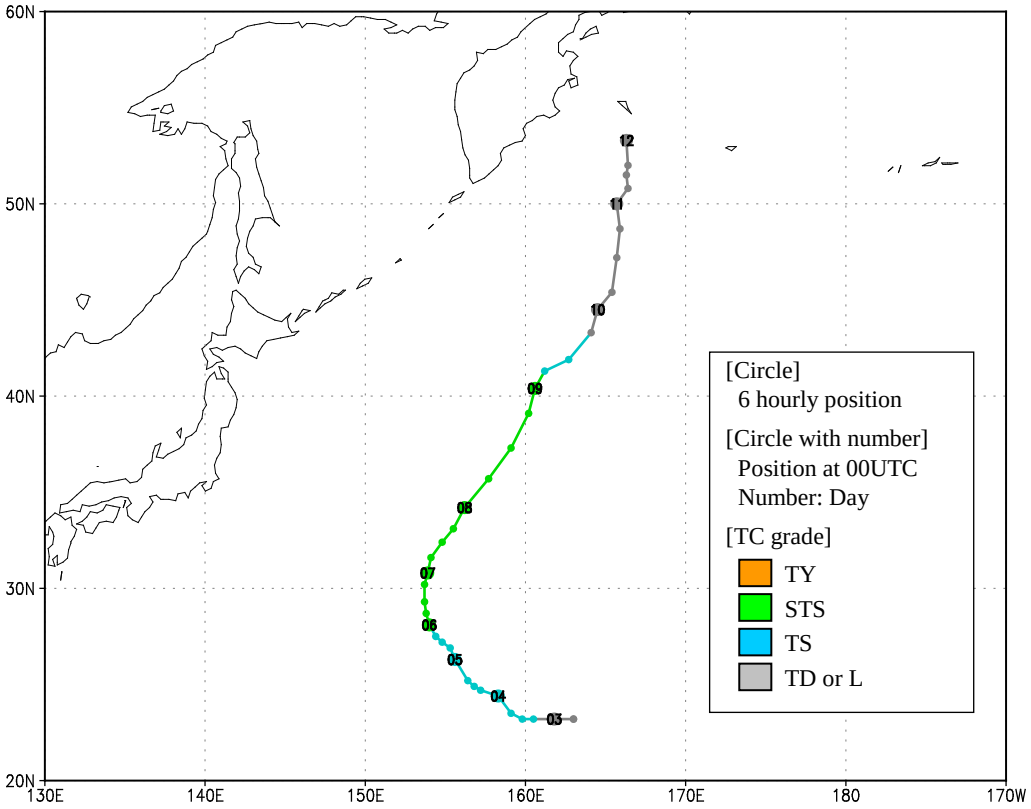
MUIFA (1109)

Muifa formed as a tropical depression (TD) southwest of Guam Island at 00 UTC on 27 July 2011. It was upgraded to tropical storm (TS) intensity at 06 UTC the next day as it followed a constant westward track. After turning northward on 29 July, Muifa was upgraded to typhoon (TY) intensity east of the Philippines at 00 UTC the next day. It developed rapidly and reached its peak intensity with maximum sustained winds of 95 kt and a central pressure of 930 hPa southwest of Okinotorishima Island at 18 UTC on 30 August. Muifa gradually turned westward on 2 August and maintained its westward track for about two days. Turning northward on 5 August, it passed around Kumejima Island with TY intensity at around 13 UTC before gradually weakening while moving northward over the East China Sea and the Yellow Sea. It hit the northern Korean Peninsula on 8 August and weakened to TD intensity in northeastern China at 00 UTC the next day. After transforming into an extratropical cyclone on 12 UTC on 9 August, it moved eastward and crossed Sakhalin Island. It moved slowly northward over the Sea of Okhotsk and dissipated at 18 UTC on 15 August.



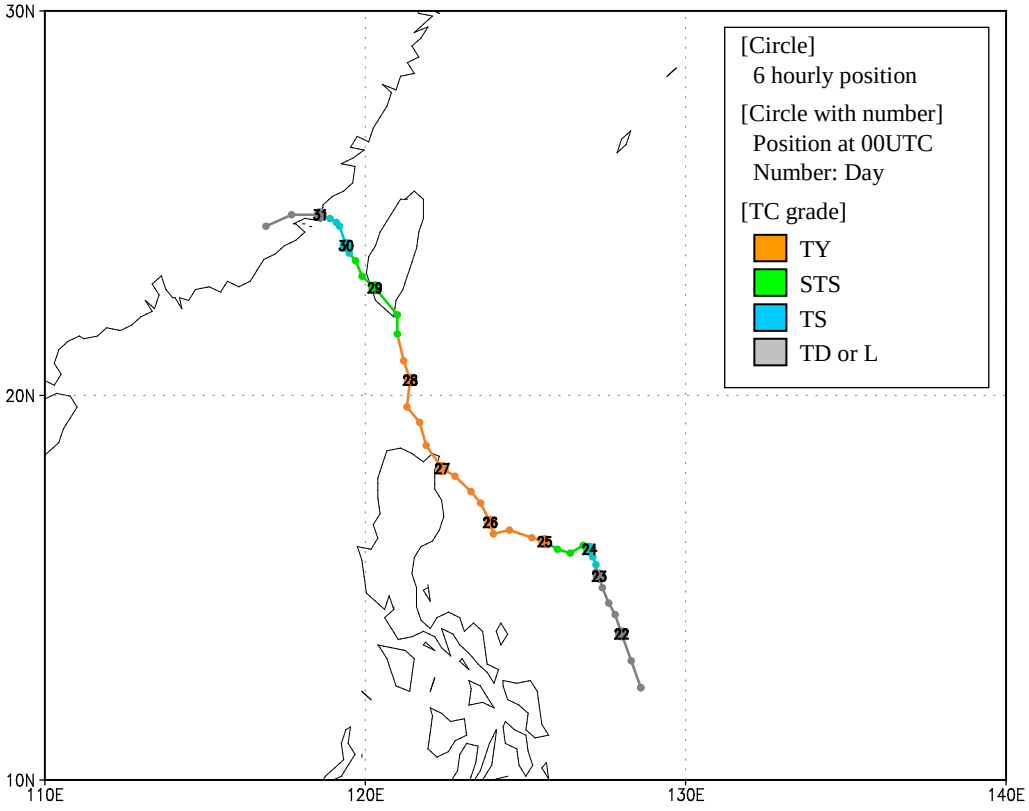
MERBOK (1110)

Merbok formed as a tropical depression (TD) northwest of Wake Island at 18 UTC on 2 August 2011. Moving westward, it was upgraded to tropical storm (TS) intensity 12 hours later. Moving west-northwestward, Merbok was upgraded to severe tropical storm (STS) intensity at 00 UTC on 6 August and it then turned northeastward and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 980 hPa at 18 UTC the next day. Keeping its northeastward track, Merbok transformed into an extratropical cyclone far east of Hokkaido Island at 18 UTC on 9 August and dissipated east of the Kamchatka Peninsula at 06 UTC on 12 August.



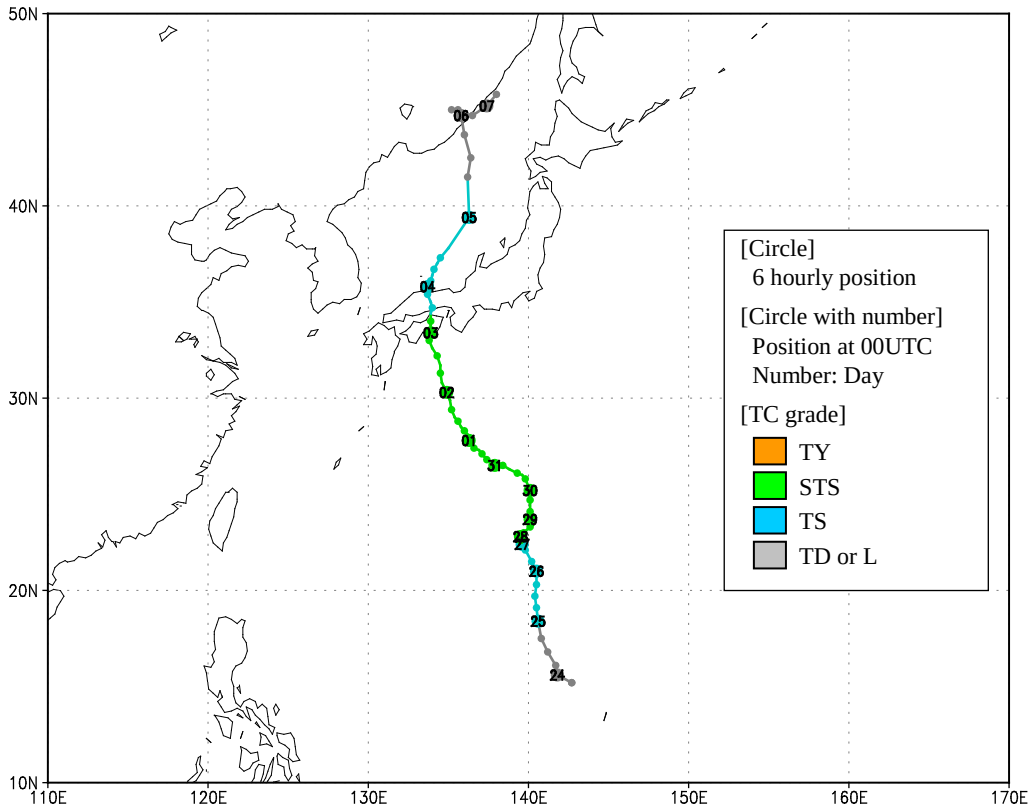
NANMADOL (1111)

Nanmadol formed as a tropical depression (TD) east of Samar Island in the Philippines at 12 UTC on 21 August 2011. Moving north-northwestward, it was upgraded to tropical storm (TS) intensity east of Luzon Island at 12 UTC on 23 August. Turning west-northwestward, Nanmadol was upgraded to typhoon (TY) intensity over the same waters at 00 UTC on 25 August and reached its peak intensity with maximum sustained winds of 100 kt and a central pressure of 925 hPa 24 hours later. Moving northwestward, it crossed the northeastern coast of Luzon Island and the southern coast of Taiwan Island, and entered the Taiwan Strait where it was downgraded to TS intensity at 18 UTC on 29 August. Turning westward, Nanmadol weakened to TD intensity over the coast of southeastern China at 00 UTC on 31 August and dissipated 18 hours later.



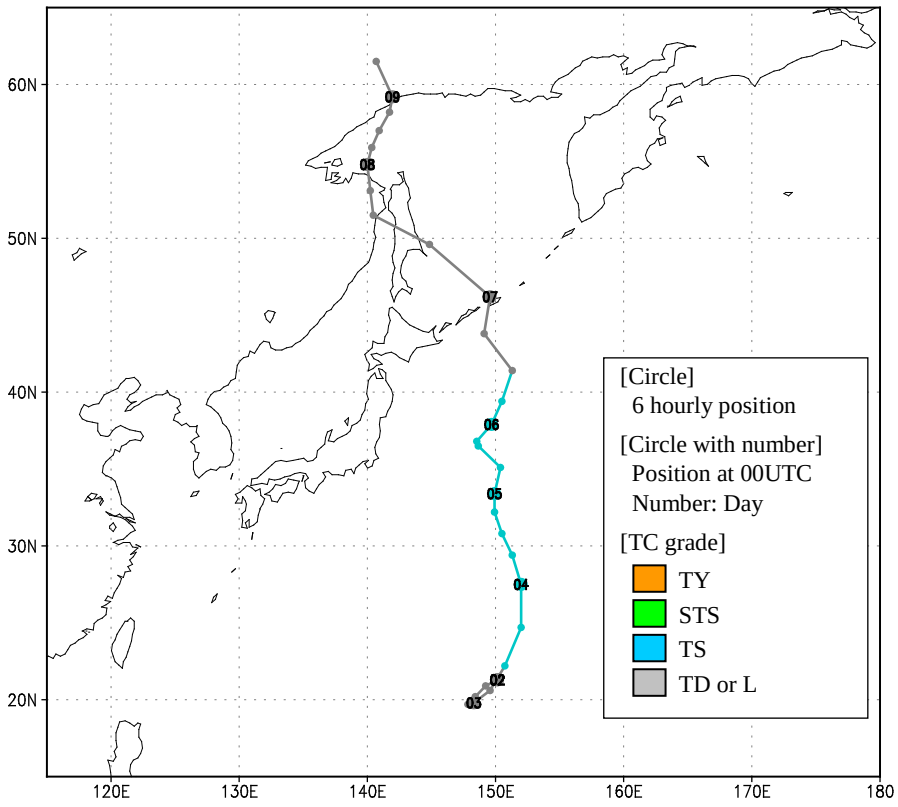
TALAS (1112)

Talas formed as a tropical depression (TD) west of the Mariana Islands at 18 UTC on 23 August 2011. Moving northwestward, it was upgraded to tropical storm (TS) intensity at 00 UTC on 25 August. Decelerating as it moved northward, Talas was upgraded to severe tropical storm (STS) intensity at 12 UTC on 27 August and reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 970 hPa southwest of Iwoto Island two days later. Turning westward then northwestward, it made landfall on Shikoku Island with STS intensity around 01 UTC on 3 September. After crossing the island northward, Talas made landfall again on Chugoku region of western Japan just after 09 UTC the same day. After moving over the Sea of Japan, it accelerated northward and transformed into an extratropical cyclone at 06 UTC on 5 September. Talas dissipated over Russia at 12 UTC on 7 September.



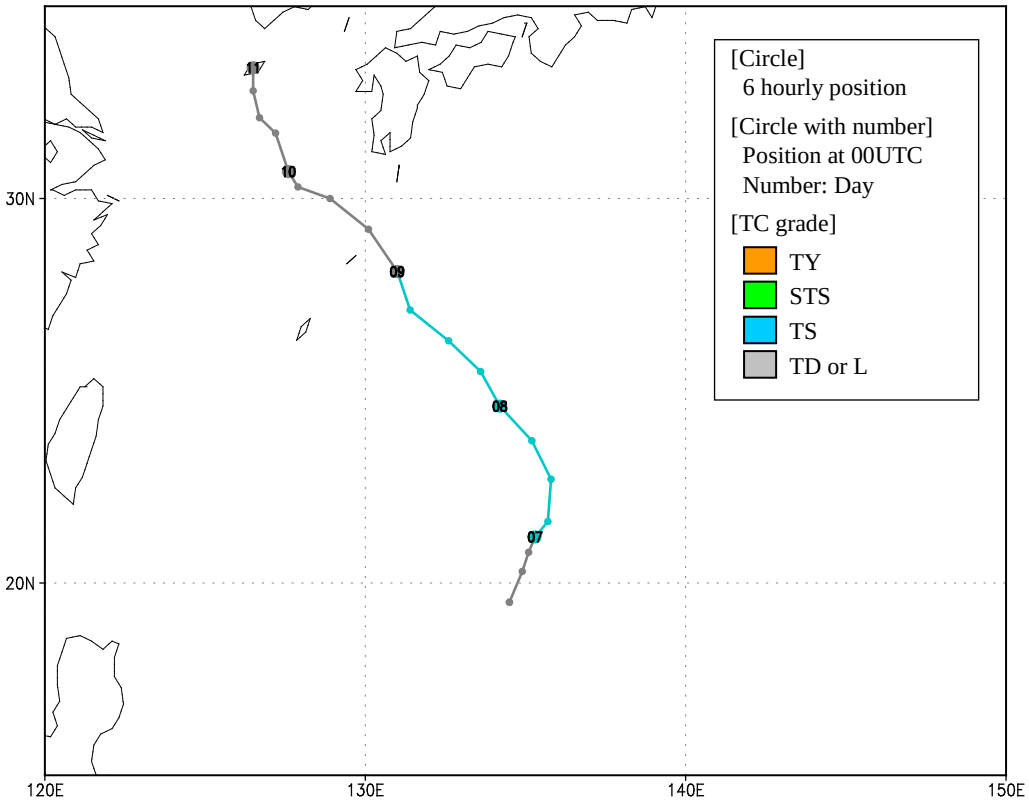
NORU (1113)

Noru formed as a tropical depression (TD) southwest of Minamitorishima Island at 00 UTC on 2 September 2011 and moved southwestward and then northeastward. Noru was upgraded to tropical storm (TS) intensity at 12 UTC the next day over the same waters and accelerated northward. It reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 990 hPa east of Japan at 06 UTC on 5 September. Noru transformed into an extratropical cyclone on 12 UTC on the next day and turned north-northwestward. After entering the Sea of Okhotsk and crossing Sakhalin Island on 7 September, it moved northward and crossed latitude 60 degrees north before 06UTC on 9 September.



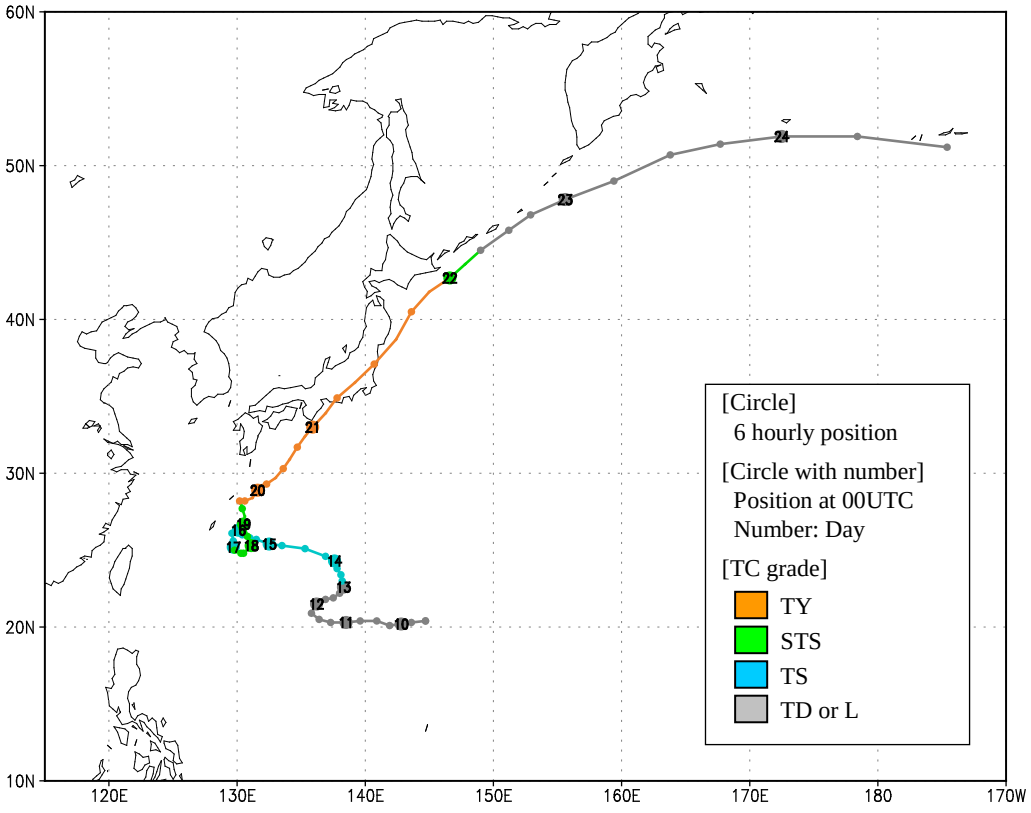
KULAP (1114)

Kulap formed as a tropical depression (TD) near Okinotorishima Island at 06 UTC on 6 September 2011. Moving northeastward, it was upgraded to tropical storm (TS) intensity at 00 UTC the next day and reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 1000 hPa six hours later. Turning gradually northwestward, Kulap weakened to TD intensity east of Amami-Oshima Island at 00 UTC on 9 September. Keeping its northwestward track, it entered the East China Sea and dissipated near Jeju Island at 06 UTC on 11 September.



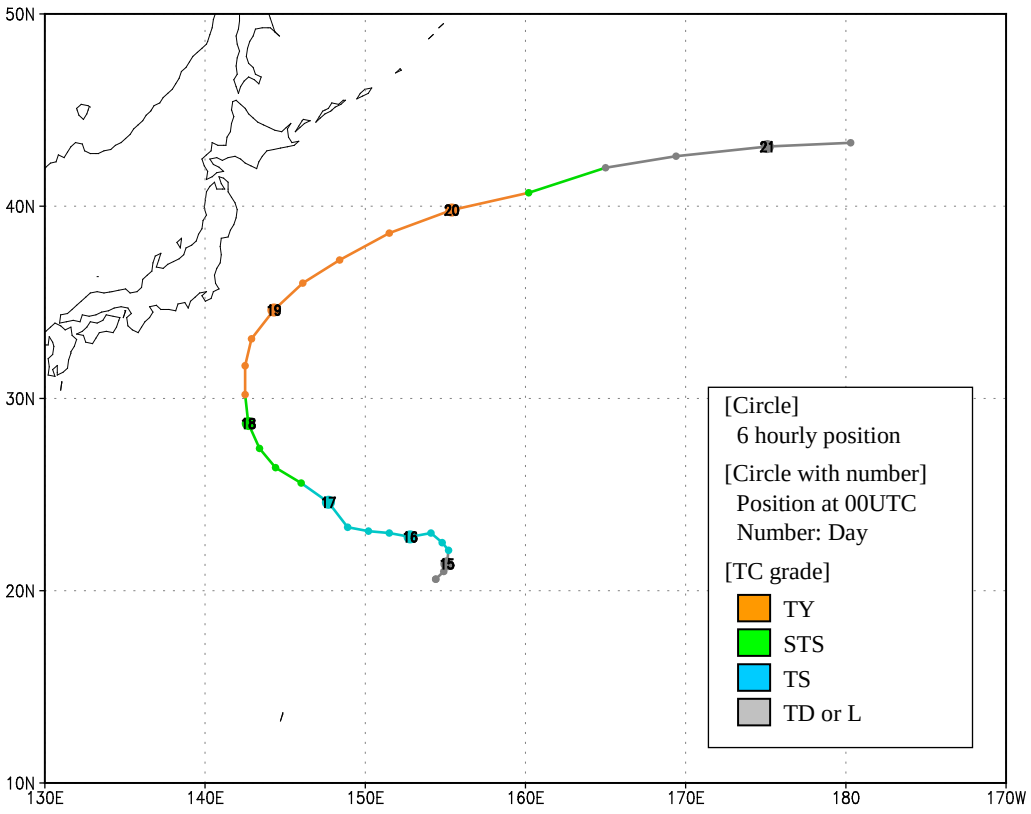
ROKE (1115)

Roke formed as a tropical depression (TD) north of the Mariana Islands at 12 UTC on 9 September 2011. After it moved westward and turned sharply northeastward, Roke was upgraded to tropical storm (TS) intensity over the sea northeast of Okinotorishima Island at 06 UTC on 13 September. It turned west-northwestward and turned in a counterclockwise direction to circle near the Daito Islands before being upgraded to typhoon (TY) intensity near Kikaijima Island at 12 UTC on 19 September. Roke reached its peak intensity with maximum sustained winds of 85 kt and a central pressure of 940 hPa 24 hours later. Moving northeastward, it made landfall around Hamamatsu City in Shizuoka Prefecture with TY intensity at around 05 UTC on 21 September. Keeping its northeastward track, Roke transformed into an extratropical cyclone east of Hokkaido Island at 06 UTC on 22 September. It moved eastward and crossed longitude 180 degrees east near the Aleutian Islands before 12 UTC on 24 September.



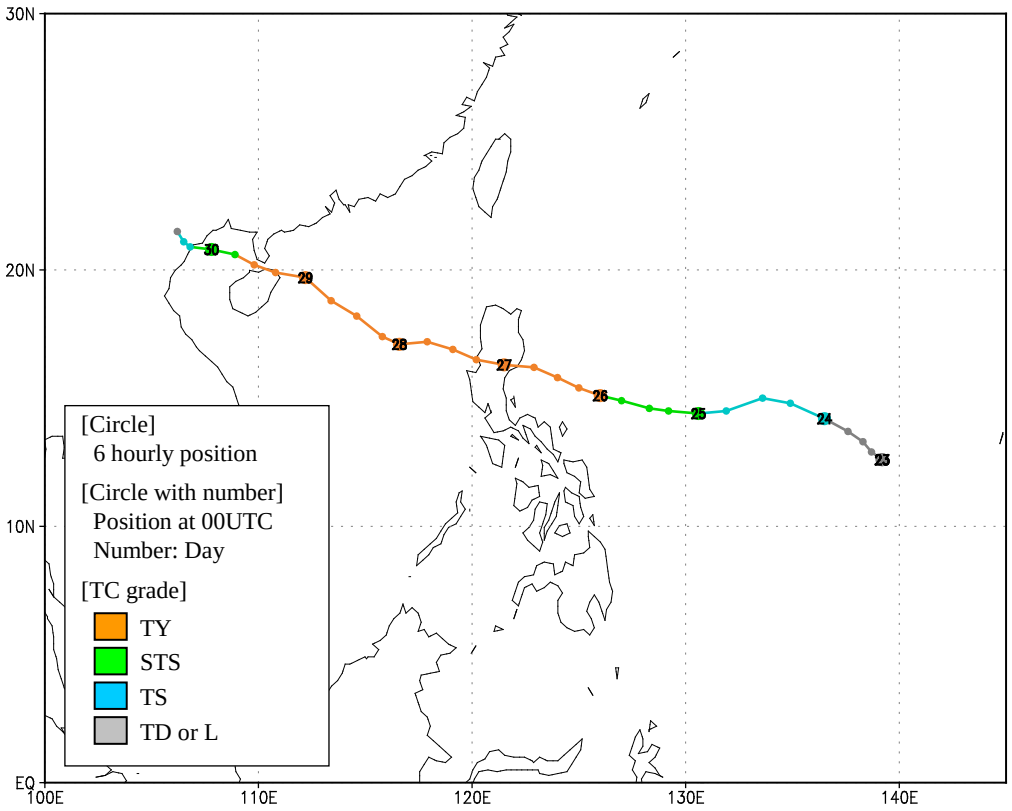
SONCA (1116)

Sonca formed as a tropical depression (TD) south of Minamitorishima Island at 12 UTC on 14 September 2011. Slowly moving northward, it was upgraded to tropical storm (TS) intensity at 06 UTC the next day. Moving westward, Sonca started recurving over the sea east of the Ogasawara Islands and was upgraded to typhoon (TY) intensity at 06 UTC on 18 September and reached its peak intensity with maximum sustained winds of 70 kt and a central pressure of 970 hPa over the sea southeast of Japan at 00 UTC the next day. Accelerating east-northeastward, Sonca transformed into an extratropical cyclone far east of Hokkaido Island at 12 UTC on 20 September. Continuing east-northeastward, it crossed longitude 180 degrees east over the sea south of the Aleutian Islands before 06 UTC the next day.



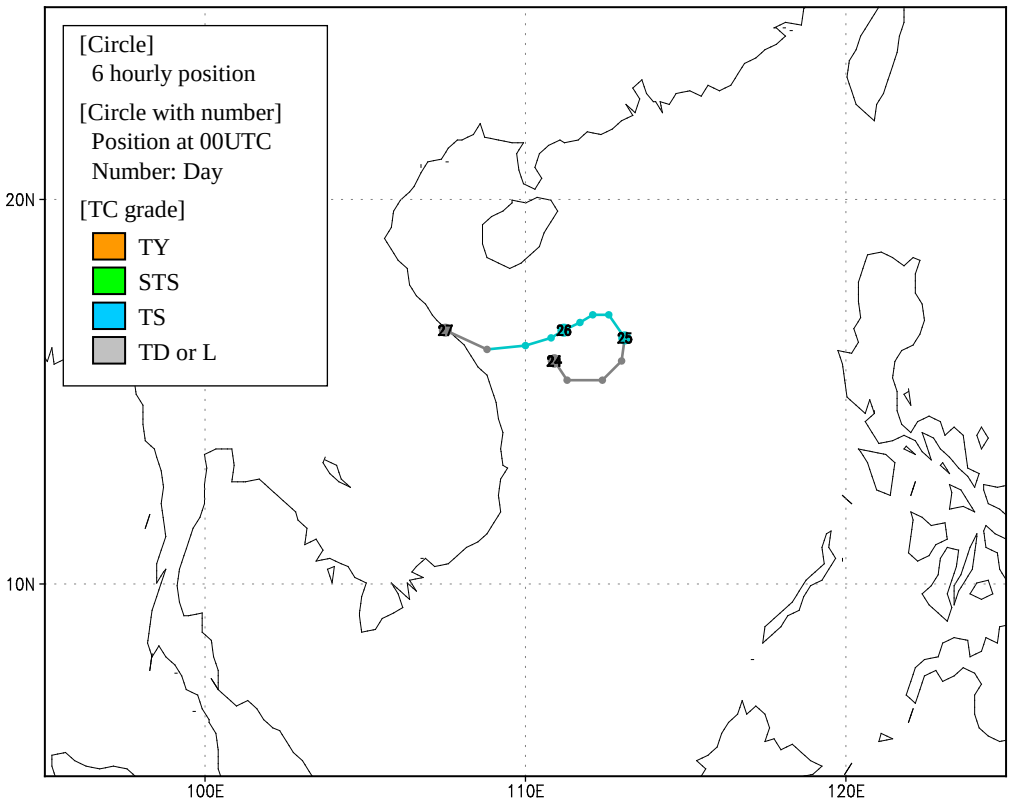
NESAT (1117)

Nesat formed as a tropical depression (TD) north of the Yap Islands at 00 UTC on 23 September 2011. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity northwest of the Yap Islands at 00 UTC the next day. Turning westward, Nesat was upgraded to typhoon (TY) intensity east of Luzon Island at 00 UTC on 26 September and reached its peak intensity with maximum sustained winds of 80 kt and a central pressure of 950 hPa at 18UTC that day just before hitting Luzon Island. After crossing the northern part of Luzon Island, it turned west-northwestward and kept its TY intensity over the South China Sea. Nesat passed around the northern coast of Hainan Island and entered the Gulf of Tonkin on 29 September. Keeping its west-northwestward track, it was downgraded to TS intensity at 06 UTC on 30 September just after hitting Viet Nam. Nesat weakened to TD intensity at 18 UTC that day and dissipated six hours later.



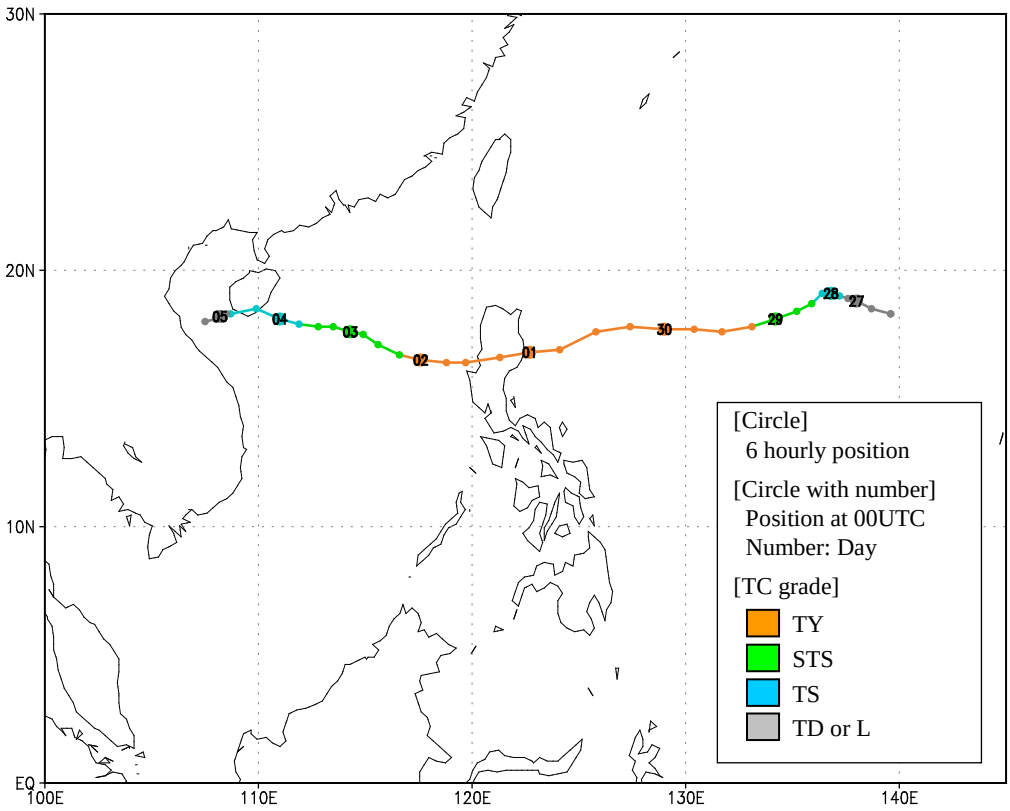
HAITANG (1118)

Haitang formed as a tropical depression (TD) south of Hainan Island over the South China Sea at 00 UTC on 24 September 2011. Moving in a counterclockwise direction, it was upgraded to tropical storm (TS) intensity and reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 996 hPa 24 hours later. Moving westward to Viet Nam, Haitang weakened to TD intensity at 18 UTC on 26 September and dissipated near the coast of Viet Nam 12 hours later.



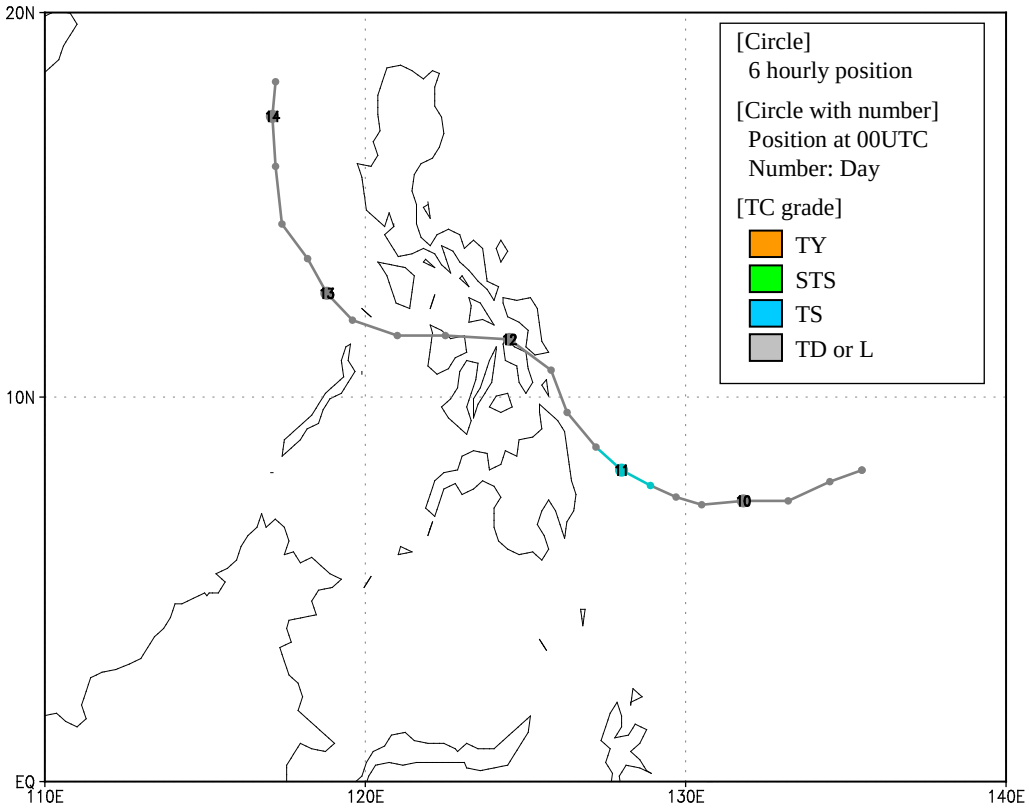
NALGAE (1119)

Nalgae formed as a tropical depression (TD) west of the Mariana Islands at 12 UTC on 26 September 2011. Moving west-northwestward, it was upgraded to tropical storm (TS) intensity southeast of Okinotorishima Island at 18 UTC the next day. Turning west-southwestward, Nalgae was upgraded to typhoon (TY) intensity southwest of Okinotorishima Island at 06 UTC on 29 September and reached its peak intensity with maximum sustained winds of 95 kt and a central pressure of 935 hPa at 00 UTC on 1 October just before hitting Luzon Island. After it crossed the northern part of Luzon Island and turned west-northwestward over the South China Sea, it was downgraded to TS intensity southeast of Hainan Island at 18 UTC on 3 October. Moving westward, Nalgae passed around the southern coast of Hainan Island and entered the Gulf of Tonkin where it weakened to TD intensity at 18 UTC on 4 October and dissipated 24 hours later.



BANYAN (1120)

Banyan formed as a tropical depression (TD) near the Palau Islands at 06 UTC on 9 October 2011. Moving westward, it was upgraded to tropical storm (TS) intensity east of Mindanao Island at 18 UTC the next day. Keeping its TS intensity for only 12 hours, Banyan weakened to TD intensity near the eastern coast of Mindanao Island. It moved westward across the Visayan Islands and entered the South China Sea before turning northward. Banyan dissipated west of Luzon Island at 12 UTC on 14 October.



WASHI (1121)

Washi formed as a tropical depression (TD) southeast of the Yap Islands at 06 UTC on 13 December 2011 and moved westward. It was upgraded to tropical storm (TS) intensity west of the Palau Islands at 06 UTC on 15 December. Keeping its westward track, Washi reached its peak intensity with maximum sustained winds of 50 kt and a central pressure of 992 hPa east of Mindanao Island at 06 UTC on 16 December just before hitting the island. It crossed Mindanao Island that day and the Sulu Sea the next day. Keeping its westward track, Washi weakened to TD intensity over the South China Sea at 00 UTC on 19 December and dissipated over the same waters six hours later.