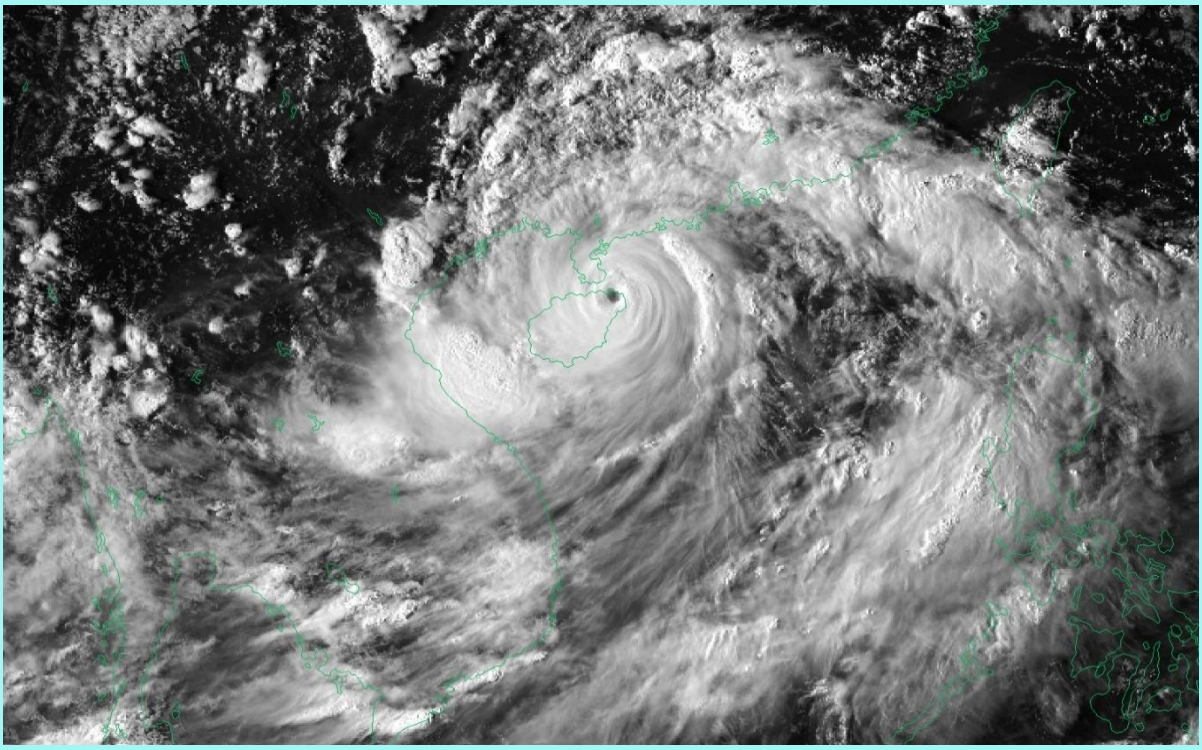
Annual Report on the Activities of the RSMC Tokyo - Typhoon Center 2024



TY YAGI 09 UTC, 6 September 2024

Japan Meteorological Agency

Annual Report on the Activities of the RSMC Tokyo - Typhoon Center 2024

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Introduction

The RSMC Tokyo - Typhoon Center (referred to here as the Center) is a Regional Specialized Meteorological Centre (RSMC) that carries out specialized activities in analysis, tracking and forecasting of western North Pacific tropical cyclones (TCs) within the framework of the World Weather Watch (WWW) Programme of the World Meteorological Organization (WMO). The Center was established at the headquarters of the Japan Meteorological Agency (JMA) in July 1989 following a designation by the WMO Executive Council at its 40th session (Geneva, June 1988).

The Center conducts the following operations on a routine basis:

(1) Preparation of information on the formation, movement and development of TCs and associated meteorological phenomena

(2) Preparation of information on synoptic-scale atmospheric situations that affect the behavior of TCs

(3) Provision of the above information to National Meteorological Services (NMSs), and in particular to United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)/WMO Typhoon Committee Members, in appropriate formats for operational processing

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

In this issue covering 2024, Chapter 1 outlines routine operations performed at the Center and its operational products, while Chapter 2 reports on its major activities in 2024. Chapter 3 describes atmospheric and oceanic conditions in the tropics and notes the highlights of TC activity in 2024. Chapter 4 presents verification statistics relating to operational forecasts (i.e., official forecasts), results from JMA's numerical weather prediction (NWP) models and other guidance models, Atmospheric Motion Vector (AMV) based Sea-surface Wind (ASWind) data, TC central pressure estimates based on satellite microwave observations and storm surge predictions. Best track data for 2024 TCs of tropical storm (TS) intensity or higher are shown in table and chart form in the appendices.

Chapter 1
Operations at the RSMC Tokyo - Typhoon Center in 2024

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

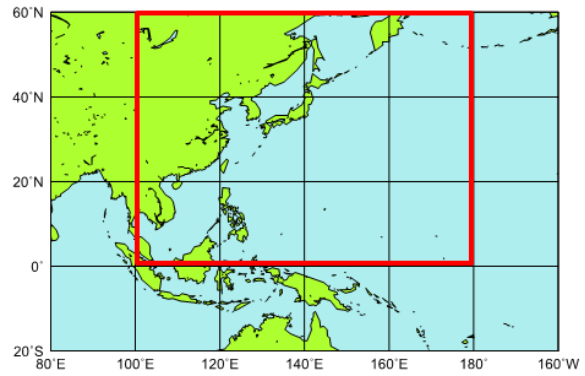


Figure 1.1
Area of responsibility of the RSMC Tokyo - Typhoon Center

1.1 Analysis

TC analysis is performed eight times a day at 00, 03, 06, 09, 12, 15, 18 and 21 UTC, and begins with determination of the TC's center position. Cloud imagery from Himawari-8/9 and microwave imagery from various polar orbiting satellites are the principal sources for this determination, especially for TCs migrating over data-sparse ocean areas. Information on the TC's direction and speed of movement is extracted primarily from six-hourly displacement vectors of the center position.

The maximum sustained wind speed in the vicinity of the TC's center is determined mainly from the Current Intensity (CI) number, which is derived from satellite imagery using the Dvorak method. The central pressure of the TC is then determined from the maximum sustained wind speed with the assumption of a certain pressure profile around the TC. The radii of circles representing winds with speeds exceeding 30 and 50 knots are determined mainly from surface observation, Advanced Scatterometer (ASCAT) observation, HY Scatterometer (HSCAT) observation and ASWind data derived from satellite images in the vicinity of the TC. The size of the central dense overcast area of the TC as observed in satellite imagery is also referenced to determine the radius of 50-knot wind speed circles.

1.2 Forecast

The Center issues TC track forecasts with probability circles, as well as intensity forecasts for tropical depressions (TDs) expected to reach tropical storm (TS) intensity within 24 hours and for TCs with TS intensity or higher up to 120 hours ahead. As a primary basis for TC track forecasts, JMA implements NWP using the Global Spectral Model (GSM) and the Global Ensemble Prediction System (GEPS). The GSM (TQ959, upgraded on 14 March 2023) has a horizontal resolution of approximately 13 km and 128 vertical layers, while GEPS (TQ479; upgraded on 14 March 2023) has 51 members with a horizontal resolution of

approximately 27 km and the same number of vertical layers. GSM horizontal resolution was enhanced from 20 to 13 km in 2023. Further details and recent model improvements are detailed in Appendix 7. Since 2015 the Center has mainly employed a consensus method for TC track forecasts. This approach involves taking the mean of predicted TC positions from multiple deterministic models, including the GSM and other NWP centers' models, such as European Centre for Medium-Range Weather Forecasts (ECMWF), National Centers for Environmental Prediction (NCEP) and United Kingdom Met Office (UKMO) global models.

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 for all forecast periods up to 120 hours is determined by the multiple ensemble method, which is solely according to the confidence level based on the cumulative ensemble spread calculated using multiple ensemble prediction systems (EPSs) consisting of ECMWF, NCEP and UKMO global EPSs in addition to GEPS.

In relation to TC intensity, the Center began providing TC intensity forecasts with extended lead times of up to 120 hours in March 2019, based on several tropical cyclone intensity forecast guidance products including Typhoon Intensity Forecasting scheme based on Statistical Hurricane Intensity Prediction Scheme (SHIPS), which is known as TIFS and Logistic Growth Equation Model (LGEM). These schemes were developed by JMA and Meteorological Research Institute (MRI) of JMA. The Center also refers to Hurricane Weather Research and Forecast model (HWRF) and Hurricane Analysis and Forecasting System (HAFS) in NCEP.

1.3 Provision of RSMC Products

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

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

RSMC products are issued while any TC of TS intensity or higher or any TD expected to reach or exceed TS intensity within 24 hours exists in the Center's area of responsibility. Appendix 6 denotes the code forms of the bulletins.

(1) RSMC Tropical Cyclone Advisory (WTPQ50-55 RJTD: via GTS)

The RSMC Tropical Cyclone Advisory is issued eight times a day after observations made at 00, 03 06, 09, 12, 15, 18 and 21 UTC, and reports the following elements in analysis and in 24-, 48-, 72-, 96- and 120-hour forecasts for TCs:

Analysis	Center position
	Accuracy of center position determination
	Direction and speed of movement
	Central pressure
	Maximum sustained wind speed (10-minute average)
	Maximum gust wind speed
	Radii of wind areas over 50 and 30 knots

24-, 48-, 72-, 96- and 120-hour Forecasts[1]	Center position and radius of probability circle
	Direction and speed of movement
	Central pressure
	Maximum sustained wind speed (10-minute average)
	Maximum gust wind speed

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

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

NWP prediction (T = 006 to 132)	Center position
	Central pressure*
	Maximum sustained wind speed*

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

(3) RSMC Guidance for Forecast by GEPS (FXPQ30-35 RJTD: via GTS)

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

NWP prediction (T = 006 to 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 the results of TC analysis including intensity information (i.e., the CI number) based on Himawari-8/9 imagery analysis using the Dvorak method. It is issued shortly after observations made for TCs with TS intensity or higher at 00, 03, 06, 09, 12, 15, 18 and 21 UTC (TDs expected to reach TS intensity or higher within 24 hours at 00, 06, 12 and 18 UTC), and reports the following elements:

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

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

[1] At 03, 09, 15 and 21 UTC, 24-, 45-, 69-, 93- and 117-hour forecasts for TCs are reported.

BUFR/CREX templates for translation into table-driven code forms are provided on the WMO website at https://community.wmo.int/activity-areas/wis/wis-manuals. The SAREP is provided in text format on the Numerical Typhoon Prediction (NTP) website (see 1.7).

(5) RSMC Prognostic Reasoning (WTPQ30-35 RJTD: via GTS)
The RSMC Prognostic Reasoning report provides brief reasoning for TC analysis and forecasts, and is issued at 00, 06, 12 and 18 UTC following the issuance of the RSMC Tropical Cyclone Advisory. The bulletin provides general comments on current positioning, intensity and related changes, synoptic situations such as those of the subtropical high and atmospheric/oceanographic fields, reasoning behind TC track and intensity forecasts (including details of methodology and guidance models), and relevant remarks in plain language.

(6) RSMC Tropical Cyclone Best Track (AXPQ20 RJTD: via GTS)
The RSMC Tropical Cyclone Best Track report provides post-analysis data on TCs of TS intensity or higher. It reports the center position, the central pressure and the maximum sustained wind speed. The best track for each TC is usually finalized three months after the termination of related issuance of the above RSMC bulletins.

(7) Tropical Cyclone Advisory for SIGMET (FKPQ30-35 RJTD: via AFTN, and IWXXM 3.0 format: via AMHS (see 1.4))
As a Tropical Cyclone Advisory Centre (TCAC) within the framework of the International Civil Aviation Organization (ICAO), the Center provides Tropical Cyclone Advisory (TCA) for SIGMET to Meteorological Watch Offices (MWOs) in order to support their preparations of SIGMET information on TCs. These advisories include the following elements in analysis and in 6-, 12-, 18- and 24-hour forecasts:

Analysis	Center position
	Observed cumulonimbus cloud
	Direction and speed of movement
	Changes in intensity
	Central pressure
	Maximum sustained wind speed (10-minute average)
Forecast	Center position
	Maximum sustained wind speed (10-minute average)

1.4 Tropical Cyclone Advisory for SIGMET

The Center provides text-format and graphical TCAs in its role as the ICAO TCAC. These include the horizontal extent of cumulonimbus cloud and cloud top height associated with TCs potentially affecting aviation safety, in addition to text-format TCA information. Both text-format and graphical TCAs and related specifications are provided online for users via linkage from the NTP website (see 1.7), and graphical TCAs are also provided to World Area Forecast Centres (WAFCs).

In November 2020, TCAs in IWXXM 3.0 format were introduced and shared on the TCAC Tokyo website, followed by transmission via Air Traffic Services (ATS) Message Handling Services (AMHS) in March 2022. The IWXXM format is detailed in Guidelines for the Implementation of OPMET Data Exchange Using IWXXM, Third Edition (May 2019), ICAO.

1.5 WIS Global Information System Centre Tokyo Server

As designated at the Sixteenth WMO Congress in June 2011, the Center introduced Data Collection or Production Centre (DCPC) service under the Global Information System Centre (GISC) Tokyo for the WMO Information System (WIS) in August 2011. It provides NWP products such as data on predicted fields in grid-point-value (GPV) form and observational values through WIS Data Discovery, Access and Retrieval (DAR) via a GISC Tokyo server (https://www.wis-jma.go.jp/). GSM products with resolution of 0.5 and 0.25 degrees (surface layer) and JMA SATAID (SATellite Animation and Interactive Diagnosis; https://www.wis-jma.go.jp/cms/sataid/) Service are also available from the server through WIS DAR. All products available via the server are listed in Appendix 8.

1.6 RSMC Tokyo - Typhoon Center Website

The RSMC Tokyo - Typhoon Center Website provides TC advisories on a real-time basis and a wide variety of products including TC analysis archives, technical reviews and annual reports on the Center's activities at https://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.html. Since November 2012, the website provides experimental TC advisory information in Common Alert Protocol (CAP) format.

1.7 Numerical Typhoon Prediction Website

Since October 2004, the Center has operated the Numerical Typhoon Prediction (NTP) website to assist the NMSs of Typhoon Committee Members in improving their TC forecasting and warning services. The site provides TC track predictions and weather maps of deterministic global NWP models from nine centers (Bureau of Meteorology (BoM, Australia), China Meteorological Administration (CMA, China), Canadian Meteorological Centre (CMC, Canada), Deutscher Wetterdienst (DWD, Germany), ECMWF, Korea Meteorological Administration (KMA, Republic of Korea), NCEP (USA), UKMO (UK) and JMA), ensemble TC track predictions of global EPSs from four centers (ECMWF, NCEP, UKMO and JMA) and a wide variety of products including the results of the Center's TC analysis, upper-air analysis, ocean analysis, storm surge and ocean wave forecasting. All products available on the website are listed in Appendix 9.

1.8 TC Communication platform

The Center's TC communication platform (developed and maintained since July 2019) supports enhanced interaction between operational forecasters in the NMSs of Typhoon Committee Members and the Center, as well as sharing of early-announcement and advance-notice updates. Full-scale operation of the platform was started during the 2021 typhoon season and related discussions have helped to clarify TC status and forecasts. All services provided on the platform are listed in Appendix 9.

Chapter 2
Major Activities of the RSMC Tokyo - Typhoon Center in 2024

2.1 Provision of RSMC Products

The Center provides operational products for TC analysis and forecasting to NMSs via the GTS, the AFTN and other networks. Monthly and annual totals of products issued in 2024 are listed in Table 2.1.

Table 2.1 Monthly and annual totals of products issued by the RSMC Tokyo - Typhoon Center in 2024

Product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
IUCC10	0	0	0	0	59	3	86	232	266	176	252	21	1095
WTPQ30-35	0	0	0	0	39	2	51	128	156	101	137	14	628
WTPQ50-55	0	0	0	0	78	3	100	255	306	198	269	27	1236
FXPQ20-25	0	0	0	0	36	1	33	100	99	75	70	13	427
FXPQ30-35	0	0	0	0	36	1	33	100	99	75	70	13	427
FKPQ30-35	0	0	0	0	39	1	49	125	150	97	132	13	606
AXPQ20	4	0	0	0	0	0	0	1	1	2	4	10	22

Notes:

IUCC10 RJTD	SAREP (BUFR format)
WTPQ30-35 RJTD	RSMC Prognostic Reasoning
WTPQ50-55 RJTD	RSMC Tropical Cyclone Advisory
FXPQ20-25 RJTD	RSMC Guidance for Forecast by GSM
FXPQ30-35 RJTD	RSMC Guidance for Forecast by GEPS
FKPQ30-35 RJTD	Tropical Cyclone Advisory for SIGMET
AXPQ20 RJTD	RSMC Tropical Cyclone Best Track

2.2 Publications

In November 2024, the Center published the *Annual Report on the Activities of the RSMC Tokyo - Typhoon Center 2023*. The publication is available on the Center's website at https://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.html.

2.3 Typhoon Committee Attachment Training

In its role as an RSMC, the Center has organized ESCAP/WMO Typhoon Committee Attachment Training annually since 2001 with the support of the WMO Tropical Cyclone Programme and the Typhoon Committee in order to advance the TC analysis and forecasting capacity of Typhoon Committee Members. The course is set under the Category 2 Unit of Tropical Cyclone Forecast Competency as per the Typhoon Committee Region specifications of the Typhoon Committee Operational Manual (TOM).

The 23rd training course was held from 15 to 26 January 2024, both in person and online, with attendees from seven Typhoon Committee Members (Hong Kong China, Lao PDR, Macao China, Malaysia, the Philippines, the Republic of Korea, and Viet Nam), two from the Panel on Tropical Cyclones (PTC) (Saudi Arabia and Sri Lanka), and online participants. This in-person attendance followed three years of online-only implementation due to COVID-19.

The course was enhanced with hands-on training for interactive exercises on satellite analysis techniques and Dvorak analysis. Presentations included content from researchers and Japanese experts from the Typhoon Committee's Hydro and Disaster Risk Reduction group, and from weathercasting professionals, to give a broad perspective and contribute to the UN's EW4All initiative.

The Center is committed to improving forecasting competence, and thereby the capacity of Meteorological Services in the Typhoon Committee region, via training to meet various regional needs, including basic application, state-of-the-art tropical cyclone forecasting and monitoring techniques/methodologies.

2.4 Other Activities in 2024

2.4.1 Upgrades of Numerical Typhoon Prediction Website

The changes outlined below were made to the NTP website in 2024.

(1) The upgraded Tropical cyclone intensity forecast guidance (TIFS) monitor and Tropical cyclone forecast verification tool became newly available in March 2024.
(2) Hurricane Analysis and Forecast System (HAFS) became newly available on the TIFS monitor in October 2024.
(3) JMA GSM extended deterministic track prediction up to 264 hours ahead at 00 and 12 initial time (UTC), became newly available in July 2024.

Chapter 3
Summary of the 2024 Typhoon Season

In 2024, 26 TCs of TS intensity or higher formed over the western North Pacific and the South China Sea. This total was almost the same as the climatological normal[2] frequency of 25.1. Among these 26 TCs, 13 reached Typhoon (TY) intensity, 3 reached severe tropical storm (STS) intensity and 10 reached TS intensity (Table 3.1).

Table 3.1 List of tropical cyclones reaching TS intensity or higher in 2024

Tropical Cyclone			Duration (UTC) (TS or higher)	Minimum Central Pressure (UTC)	lat(N)	long(E)	(hPa)	Max Wind (kt)
TY	Ewiniar	(2401)	251200 May - 301800 May	270000	15.8	122.8	970	75
TS	Maliksi	(2402)	310000 May - 311200 May	310000	19.8	112.6	998	35
TY	Gaemi	(2403)	200000 Jul - 261800 Jul	240300	23.9	122.9	935	90
STS	Prapiroon	(2404)	210000 Jul - 231200 Jul	220600	20.1	108.5	985	55
STS	Maria	(2405)	071800 Aug - 120600 Aug	081800	29.8	145.6	980	55
TS	Son-tinh	(2406)	110000 Aug - 131200 Aug	111200	28.8	154.5	994	40
TY	Ampil	(2407)	121200 Aug - 190000 Aug	151200	31.6	140.8	950	85
TS	Wukong	(2408)	130000 Aug - 141200 Aug	130000	26.4	150.1	1002	35
TS	Jongdari	(2409)	181200 Aug - 210000 Aug	190600	26.3	126.0	996	40
TY	Shanshan	(2410)	211800 Aug - 301200 Aug	271500	28.8	130.3	935	95
TY	Yagi	(2411)	010600 Sep - 081200 Sep	050000	19.0	115.8	915	105
TS	Leepi	(2412)	050000 Sep - 061200 Sep	050000	32.2	145.9	1002	35
TY	Bebinca	(2413)	101200 Sep - 170000 Sep	150000	29.6	127.2	965	75
TS	Pulasan	(2414)	151200 Sep - 210600 Sep	170000	20.0	140.1	992	45
TS	Soulik	(2415)	181800 Sep - 191200 Sep	181800	17.5	110.0	992	35
TS	Cimaron	(2416)	240600 Sep - 260600 Sep	241200	27.9	135.1	998	35
TY	Jebi	(2417)	270000 Sep - 021200 Oct	010000	32.6	141.7	980	65
TY	Krathon	(2418)	280000 Sep - 031200 Oct	010000	20.6	119.6	920	105
TS	Barijat	(2419)	060600 Oct - 110000 Oct	101800	39.2	154.2	985	45
STS	Trami	(2420)	211800 Oct - 271800 Oct	260600	17.1	111.9	970	60
TY	Kong-rey	(2421)	241800 Oct - 011200 Nov	300000	19.1	124.8	925	100
TY	Yinxing	(2422)	031200 Nov - 120600 Nov	070600	18.5	122.4	945	100
TY	Toraji	(2423)	090600 Nov - 141200 Nov	101800	15.9	123.2	980	70
TY	Man-yi	(2424)	081800 Nov - 191200 Nov	160000	12.6	126.7	920	105
TY	Usagi	(2425)	111800 Nov - 160000 Nov	140000	17.2	123.1	940	95
TS	Pabuk	(2426)	220600 Dec - 241800 Dec	220600	10.5	114.2	1002	35

3.1 Atmospheric and Oceanographic Conditions in the Tropics

In association with the El Niño event that began in boreal spring (March – May) 2023, positive sea surface temperature (SST) anomalies were observed over most of the region, with remarkably positive anomalies from central to eastern parts in boreal winter (December 2023 – February 2024). Tropical convection was enhanced over the equatorial Pacific and the western Indian Ocean, and suppressed from the eastern Indian Ocean to Indonesia.

[2] The base period for the climatological normal is 1991 – 2020. The normal was updated in early 2021 based on 30-year data.

Even though the El Niño event ended in boreal spring 2024, remarkably positive SST anomalies were still observed from western to central parts of the equatorial Pacific as the event had persisted since boral spring 2023. In accordance with SST conditions, tropical convective activity was enhanced from the western Indian Ocean to the south of New Guinea Island, and suppressed from the Bay of Bengal to the east of the Philippines.

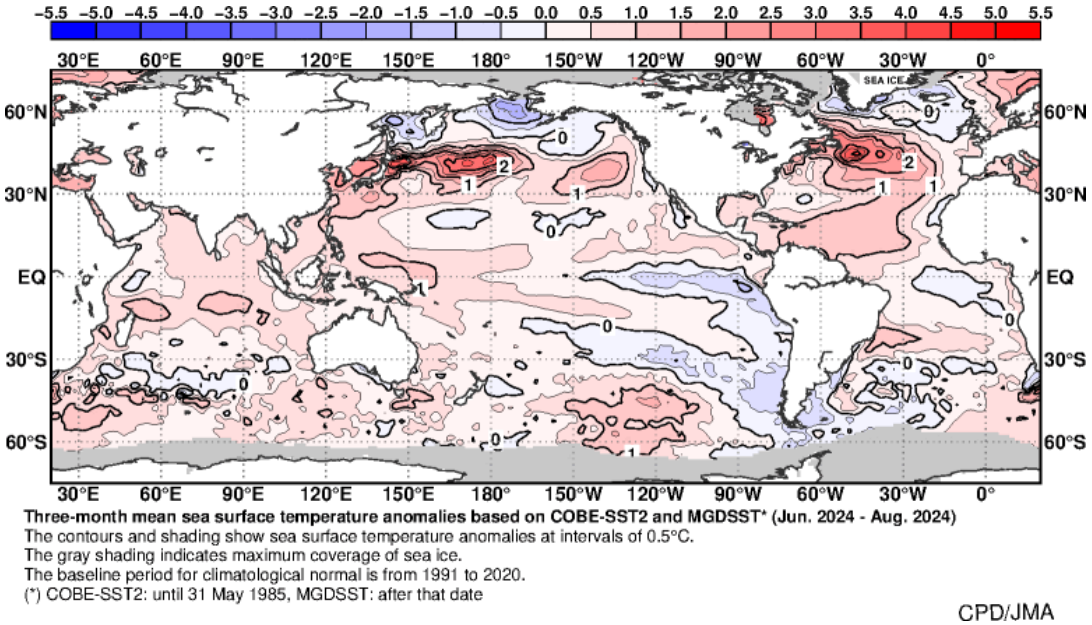
Boreal summer (June – August) saw remarkably positive SST anomalies in western parts and negative anomalies in eastern parts of the equatorial Pacific. In the Indian Ocean, remarkably positive SST anomalies were observed over a wide area (Figure 3.1 (a)). Since warmer SSTs tend to occur in the tropical Indian Ocean after El Niño events, this SST pattern may be associated with the expired El Niño event. Tropical convective activity was enhanced from eastern North Africa to the western Indian Ocean, from western South Asia to Indonesia and to the southeast of Japan, and suppressed over a wide area of the tropical North Pacific (Figure 3.1 (b)). In the lower troposphere, anti-cyclonic circulation anomalies were seen from the East China Sea to the subtropical western North Pacific in association with enhanced convection from the Indian Ocean to the Maritime Continent, indicating that the southwestward extension of the North Pacific subtropical high was stronger than normal (Figure 3.1 (c)). The anti-cyclonic circulation anomalies observed over the tropical Pacific indicate unfavorable conditions for typhoons, and may have contributed to the reduced number of formations observed until July (see 3.2).

In boreal autumn (September – November), remarkably positive SST anomalies were observed in the western part of the equatorial Pacific, and negative anomalies extended from eastern to central parts. In the Indian Ocean, remarkably positive SST anomalies were still extensively observed, except in areas off Somalia and a few elsewhere. Tropical convective activity was enhanced in the central South Indian Ocean and from the northern South China Sea to the subtropical western North Pacific, and suppressed from the western to central equatorial Pacific. In the lower troposphere, cyclonic circulation anomalies straddling the equator were seen in the eastern Pacific and the Indian Ocean, and anti-cyclonic circulation anomalies straddling the equator were seen from the western to central Pacific.

Atmospheric and oceanographic charts (including monthly mean streamlines at 850 and 200 hPa, outgoing longwave radiations (OLRs)[3] with related anomalies, and monthly mean SSTs with related anomalies for the western North Pacific and the South China Sea) are provided on the Tokyo Climate Center website at
https://www.data.jma.go.jp/tcc/tcc/products/clisys/figures/db_hist_mon_tcc.html and
https://www.data.jma.go.jp/tcc/tcc/products/elnino/ocean/index_tcc.html.

[3] OLR data were calculated using information provided by the Climate Prediction Center/NOAA at https://ftp.cpc.ncep.noaa.gov/precip/CBO_V1/.

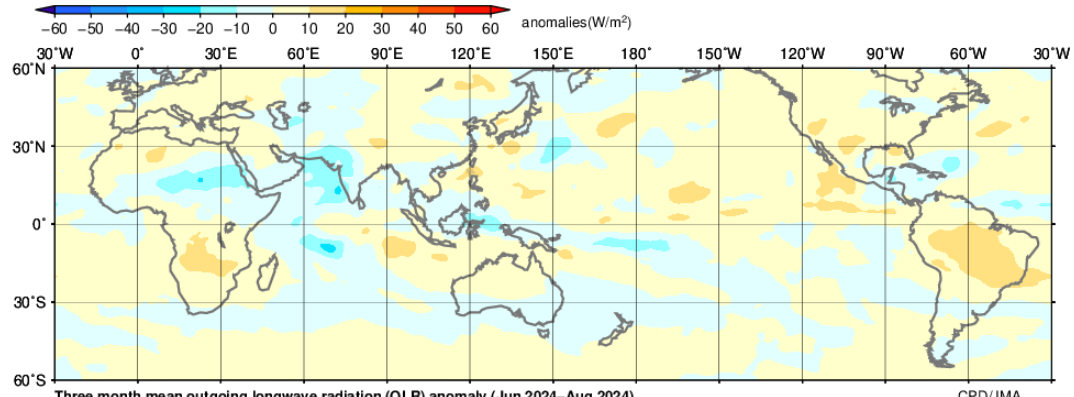
(a)



Three-month mean sea surface temperature anomalies based on COBE-SST2 and MGDSST* (Jun. 2024 - Aug. 2024)
The contours and shading show sea surface temperature anomalies at intervals of 0.5°C.
The gray shading indicates maximum coverage of sea ice.
The baseline period for climatological normal is from 1991 to 2020.
(*) COBE-SST2: until 31 May 1985, MGDSST: after that date

CPD/JMA

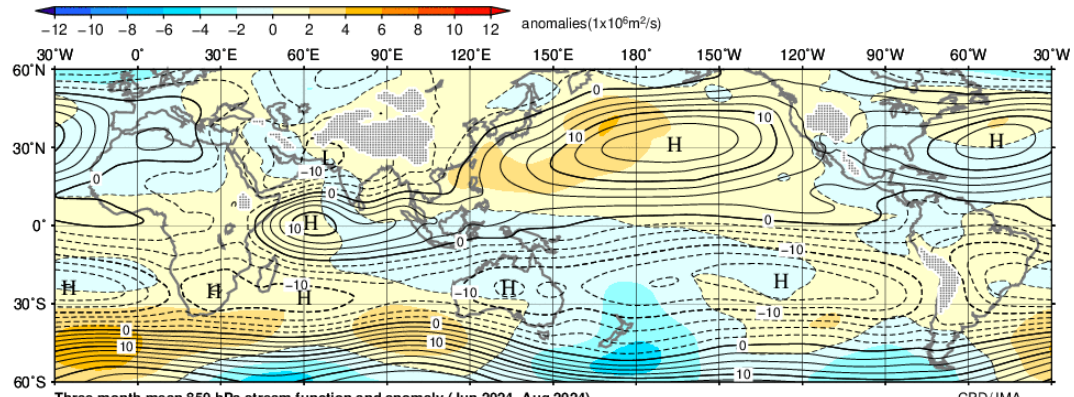
(b)



Three month mean outgoing longwave radiation (OLR) anomaly (Jun.2024–Aug.2024)
Anomalies are deviations from the 1991–2020 average.
Original data (CPC Blended OLR) provided by NOAA.

CPD/JMA

(c)



Three month mean 850 hPa stream function and anomaly (Jun.2024–Aug.2024)
The contours show the stream function at intervals of 2.5x10⁶ m²/s, and the shading shows stream function anomalies.
The hatch patterns indicate areas with altitudes exceeding 1,600 m.
Anomalies are deviations from the 1991–2020 average.

CPD/JMA

Figure 3.1 Three-month mean (a) sea surface temperature (SST) anomaly, (b) outgoing longwave radiation (OLR) anomaly, and (c) 850-hPa stream function (contours) and related anomaly (shading) in boreal summer (June – August 2024)

The base period for the normal is 1991 – 2020. (a) The contour interval is 0.5°C. Sea ice coverage areas are shaded in gray. (b) Negative (cold color) and positive (warm color) OLR anomalies show enhanced and suppressed convection, respectively, compared to the normal. Original data is provided by NOAA. (c) The contour interval is 2.5 x 10^6 m^2/s. “H” and “L” denote high- and low-pressure systems, respectively.

3.2 Tropical Cyclones in 2024

A total of 26 named TCs formed over the western North Pacific and the South China Sea in 2024, which was almost the same as the climatological normal. Monthly and normal numbers of named TC formations are shown in Figure 3.2, and the tracks of the 26 TCs are shown in Figure 3.3. Figure 3.4 shows the genesis points of these TCs (dots) and related frequency distribution for past years (1951 – 2023).

The 2024 typhoon season started in May with Ewiniar (2401), which formed over the sea east of Mindanao. A total of 4 had formed by July, which was below the average of 7.8, and the other 22 formed from August onward, which was higher than the average of 17.3. The El Niño event that continued until spring suppressed convection in the tropical western North Pacific until the end of July, as per conditions observed in other post-El Niño summers, and suppressed tropical cyclone genesis. However, the number of named TC formations increased from August onward, probably in association with weakened influence from the El Niño event and enhanced convection from the Philippines to the southeast of Japan in August and September.

The mean genesis point of named TCs was 17.9˚N and 134.7˚E, representing a north-westward deviation from that of the 30-year average[4] (16.3˚N and 135.9˚E) (see Figure 3.4). The mean genesis point of named TCs formed in summer (June to August) was 21.9˚N and 136.6˚E, with north-eastward deviation from that of the 30-year summer average (18.5˚N and 134.2˚E), and that of named TCs formed in autumn (September to November) was 16.5˚N and 137.3˚E, which was almost the same area as that of the 30-year autumn average (16.2˚N and 137.0˚E).

The mean duration of TCs sustaining TS intensity or higher was 4.8 days, which was shorter than that of the 30-year average (5.2 days). The mean duration of TCs sustaining TS intensity or higher formed in summer was 4.4 days, which was shorter than that of the 30-year average (5.0 days), and the mean duration of TCs sustaining TS intensity or higher formed in autumn was 5.5 days, which was almost the same as that of the 30-year average (5.4 days).

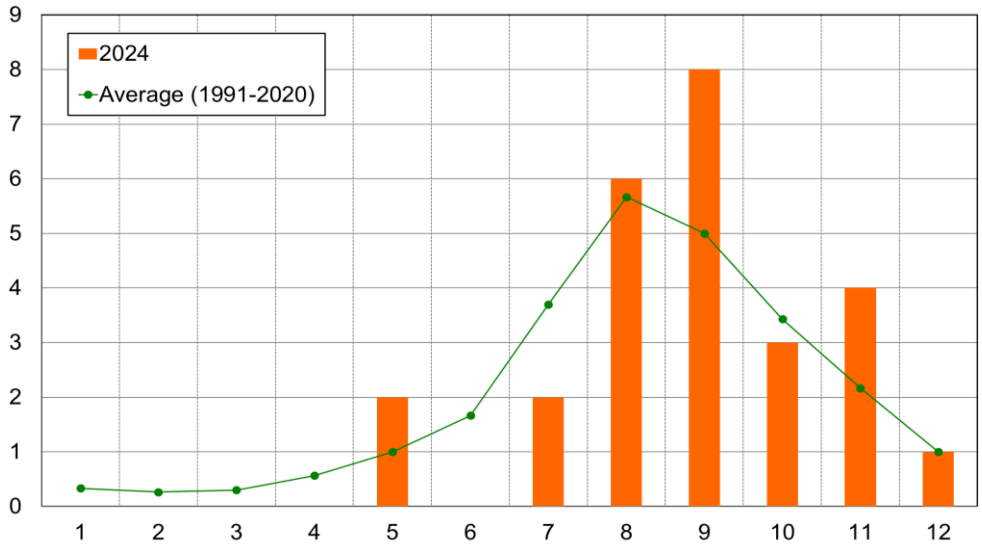


Figure 3.2 Monthly number of named TC formation for 2024 compared to the climatological normal

[4] The 30-year averaging period is from 1991 to 2020.

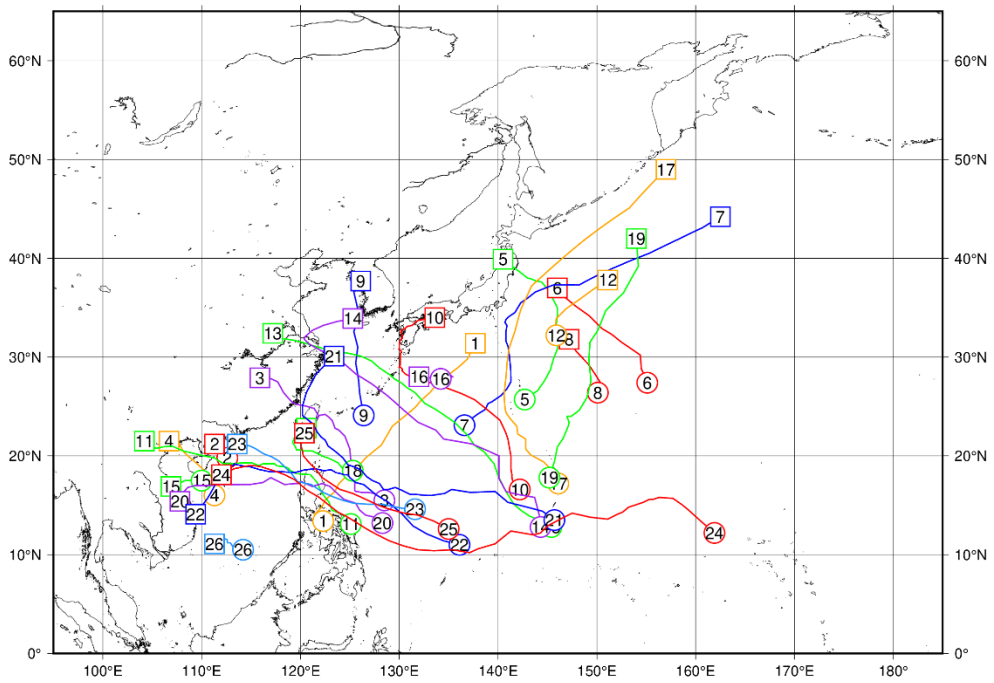


Figure 3.3 Tracks of the 26 named TCs that formed in 2024. TC tracks for those with an intensity of TS or higher are shown.

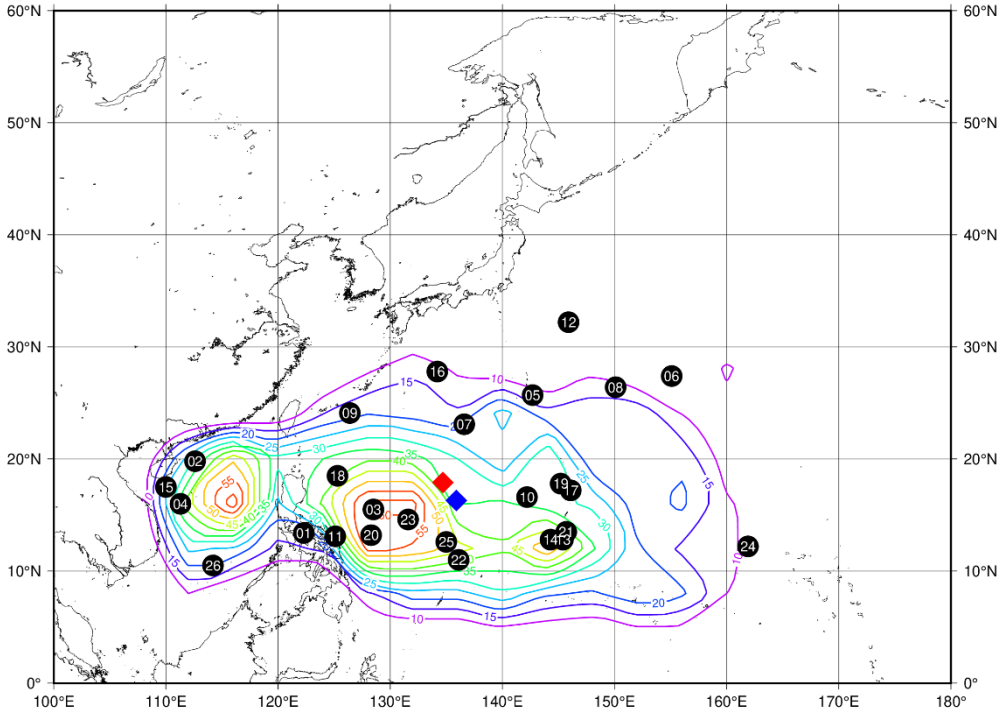


Figure 3.4 Genesis points of the 26 named TCs forming in 2024 (dots) and related frequency distribution for 1951 - 2023 (lines). Red and blue diamond show the mean genesis points of TCs forming in 2024 and the 30-year average period (1991 – 2020), respectively.

Chapter 4
Verification of Forecasts and Other Products in 2024

4.1 Verification of Operational Forecasts

Operational forecasts for the 26 named TCs that formed in 2024 were verified using RSMC TC best track data[5]. The verified elements were forecasts of the center position, central pressure and maximum sustained wind speed (up to five days ahead). In addition to forecast errors, improvement ratios of forecast errors to climatological model were also evaluated to assess operational forecast skill. Forecasts issued at 00, 06, 12 and 18 UTC were included in verification for TCs classified in best track data as TS, STS or TY at both initial and forecast valid times. The position and intensity errors of such operational forecasts are shown in bold face in Appendix 3. (Those for TD before upgrading to TS intensity or higher are indicated in italic face in Appendix 3.)

4.1.1 Center Position

Figure 4.1 shows annual mean errors in TC track forecasts covering periods of 24 hours (since 1982), 48 hours (since 1989), 72 hours (since 1997), 96 hours and 120 hours (since 2009). It can be seen that operational TC track forecasts have steadily improved since 1982, although year-to-year fluctuations are seen due in part to differences in TC characteristics. The improvement observed since 2015 is partially attributed to the introduction of the consensus method using four global numerical models of ECMWF, JMA, NCEP and UKMO for operational forecasts in that year. The errors in 2024 were 71, 106, 152, 245 and 424 km for 24-, 48-, 72-, 96- and 120-hour forecasts, respectively. Forecast errors for 48 and 72 hours in 2024 were the lowest on record, while those for 120-hour forecasts were comparatively high in relation to recent years.

The annual mean improvement ratios in relation to the climatology and persistence model (CLIPER)[6] for TC track prediction since 2011 are shown in Figure 4.2 to support evaluation of the operational forecast skill. The values are defined as

$$\frac{\text{Mean Position Error (CLIPER)} - \text{Mean Position Error (Operational)}}{\text{Mean Position Error (CLIPER)}}$$

and positive/negative values indicate that the operational forecasts were better/worse than the CLIPER predictions. Although there are year-to-year fluctuations, it can be seen that operational forecasts have steadily improved in the long term. The annual mean improvement ratios for 24-, 48-, 72-, 96- and 120-hour forecasts in 2024 were 65% (59% in 2023), 77% (69%), 78% (72%), 71% (70%) and 61% (68%), respectively. Forecast improvement ratios for 48 and 72 hours in 2024 were the highest on record.

The details of errors including improvement ratios to CLIPER for each named TC that formed in 2024 are summarized in Table 4.1. Forecasts for Shanshan (2410) was characterized by large errors. This was attributable to the fact that guidance models predicted more northern tracks than reality due to an inability to adequately predict the influence of an upper cold low around the typhoon during its formation and

[5] Maximum sustained wind speed of TD is not described in best track data or operational forecast. Therefore, maximum sustained wind speed of TD was treated as 30 kt for convenience in verification in 4.1.

[6] The Center operates the CLIPER model based on Aberson (1998), Neumann (1972) and Merrill (1980). The model uses no information on current atmospheric status, but best track data such as TC center position/central pressure/movement and dates. Multiple regression coefficients for the model were generated from best track data between 1980 and 2010.

development stages.

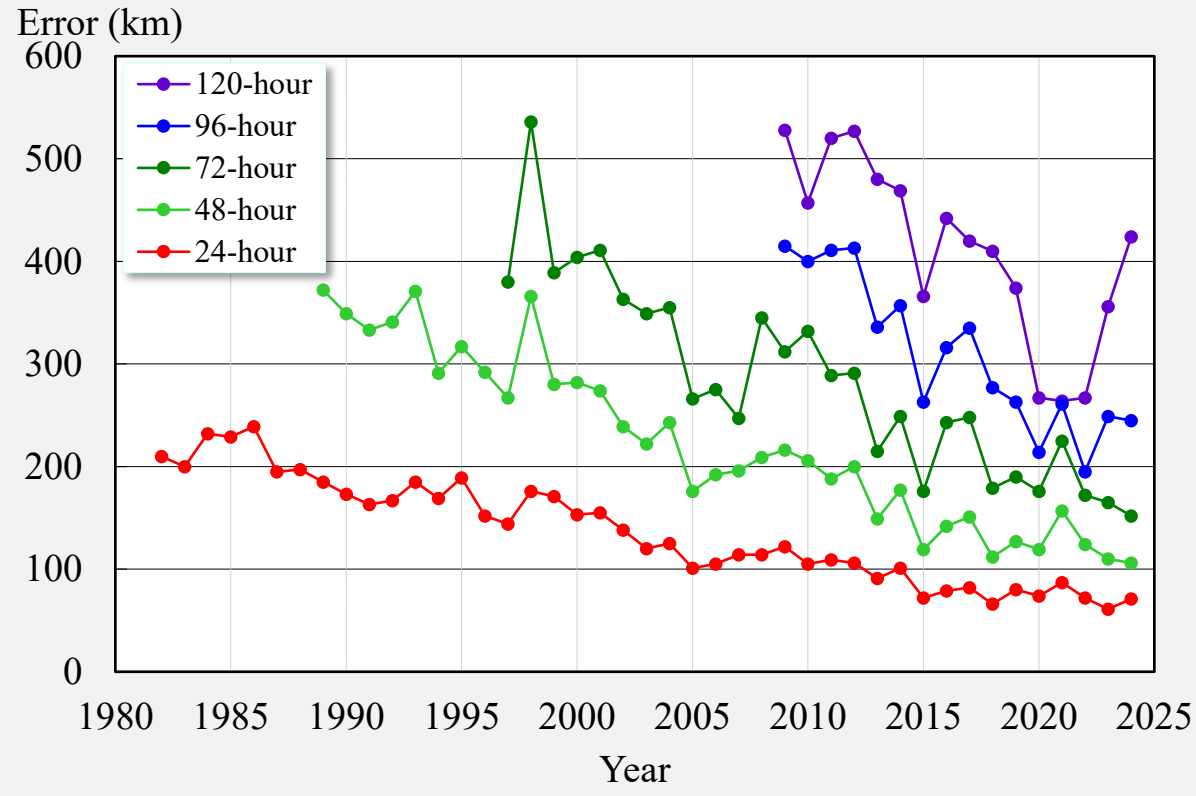


Figure 4.1 Annual mean position errors in 24-, 48-, 72-, 96- and 120-hour operational track forecasts

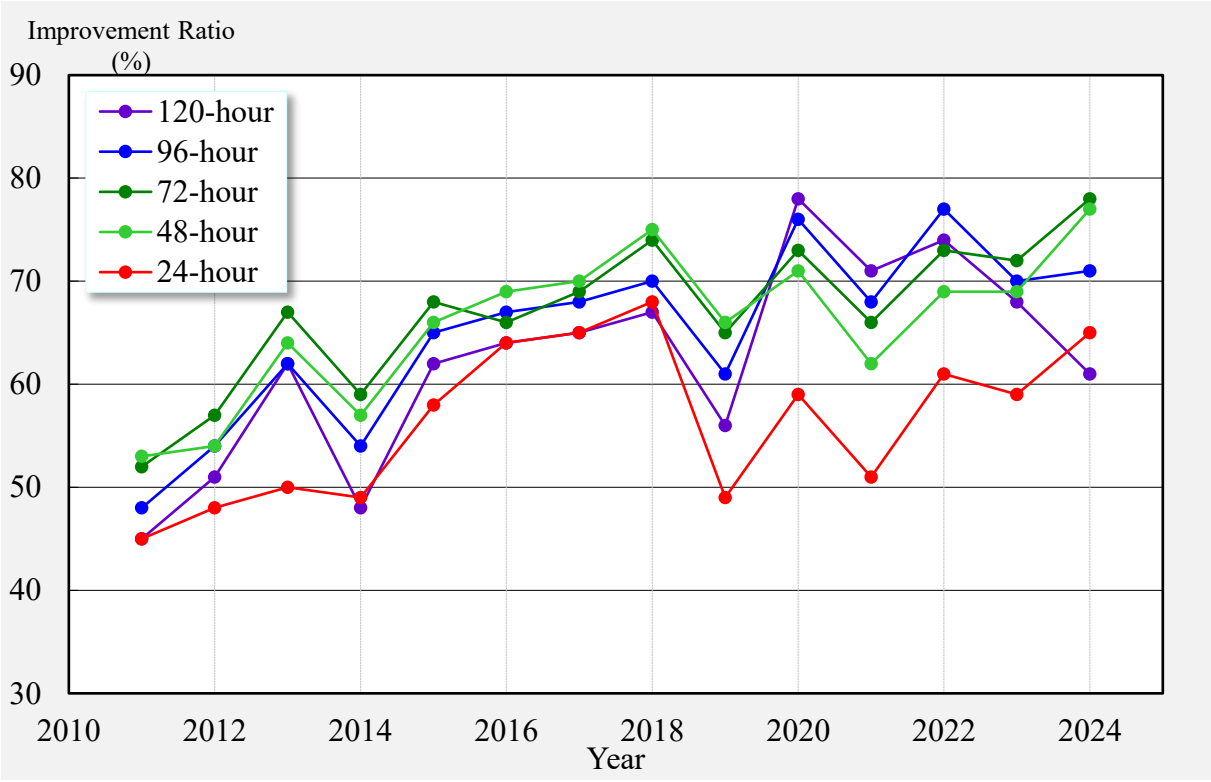


Figure 4.2 Annual mean improvement ratios in 24-, 48-, 72-, 96- and 120-hour operational track forecasts.

Table 4.1 Mean position errors of 24-, 48-, 72-, 96- and 120-hour operational forecasts for each named TC that formed in 2024. S.D., Num. and Impr. represent the standard deviation of operational forecast position errors, number of samples and improvement ratio (see the equation in 4.1.1 for detail), respectively.

Tropical Cyclone			24-hour Forecast				48-hour Forecast				72-hour Forecast				96-hour Forecast				120-hour Forecast			
			Mean (km)	S.D. (km)	Num.	Impr. (%)	Mean (km)	S.D. (km)	Num.	Impr. (%)	Mean (km)	S.D. (km)	Num.	Impr. (%)	Mean (km)	S.D. (km)	Num.	Impr. (%)	Mean (km)	S.D. (km)	Num.	Impr. (%)
TY	Ewiniar	(2401)	49	21	17	78	63	32	13	85	71	35	9	90	125	22	5	88	261	0	1	84
TS	Maliksi	(2402)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Gaemi	(2403)	69	51	23	64	79	35	19	83	108	65	15	82	178	123	11	63	307	91	7	30
STS	Prapiroon	(2404)	57	29	6	71	90	14	2	74	-	-	0	-	-	-	0	-	-	-	0	-
STS	Maria	(2405)	41	21	14	82	57	24	10	91	108	62	6	87	322	21	2	61	-	-	0	-
TS	Son-tinh	(2406)	43	26	6	86	111	1	2	84	-	-	0	-	-	-	0	-	-	-	0	-
TY	Ampil	(2407)	69	34	22	63	96	40	18	70	129	46	14	66	158	59	10	69	187	94	6	79
TS	Wukong	(2408)	138	14	2	56	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TS	Jongdari	(2409)	38	16	5	87	82	0	1	91	-	-	0	-	-	-	0	-	-	-	0	-
TY	Shanshan	(2410)	63	43	31	66	117	56	27	73	213	156	23	69	583	307	19	34	1227	411	15	-19
TY	Yagi	(2411)	72	55	25	49	111	102	21	62	130	105	17	74	243	149	13	64	368	238	9	51
TS	Leepi	(2412)	105	0	1	27	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Bebinca	(2413)	74	30	22	71	105	36	18	85	125	67	14	89	143	54	10	90	99	31	6	92
TS	Pulasan	(2414)	127	50	19	71	201	40	13	82	293	74	9	85	343	16	3	84	639	41	2	68
TS	Soulik	(2415)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TS	Cimaron	(2416)	51	0	1	77	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Jebi	(2417)	94	58	18	57	116	57	14	77	100	79	10	86	134	53	6	87	129	62	2	92
TY	Krathon	(2418)	51	23	18	64	116	32	14	62	237	32	10	36	360	74	6	7	556	21	2	0
TS	Barijat	(2419)	105	47	12	66	141	84	8	79	157	60	4	82	-	-	0	-	-	-	0	-
STS	Trami	(2420)	76	35	20	59	91	47	16	79	147	108	12	79	198	97	8	82	287	63	4	74
TY	Kong-rey	(2421)	87	79	27	49	90	81	23	74	132	44	19	75	212	50	15	75	335	72	11	75
TY	Yinxing	(2422)	40	29	31	77	76	53	27	81	141	68	23	76	217	115	19	74	260	168	15	78
TY	Toraji	(2423)	52	36	17	54	89	55	13	58	95	28	9	66	145	58	5	63	214	0	1	12
TY	Man-yi	(2424)	98	75	38	50	154	118	34	65	196	147	30	72	145	83	17	83	185	107	13	86
TY	Usagi	(2425)	37	16	13	62	62	30	9	74	61	21	5	84	135	0	1	74	-	-	0	-
TS	Pabuk	(2426)	93	29	6	29	120	21	2	58	-	-	0	-	-	-	0	-	-	-	0	-
Annual Mean (Total)			71	53	394	65	106	74	304	77	152	107	229	78	245	197	150	71	424	416	94	61

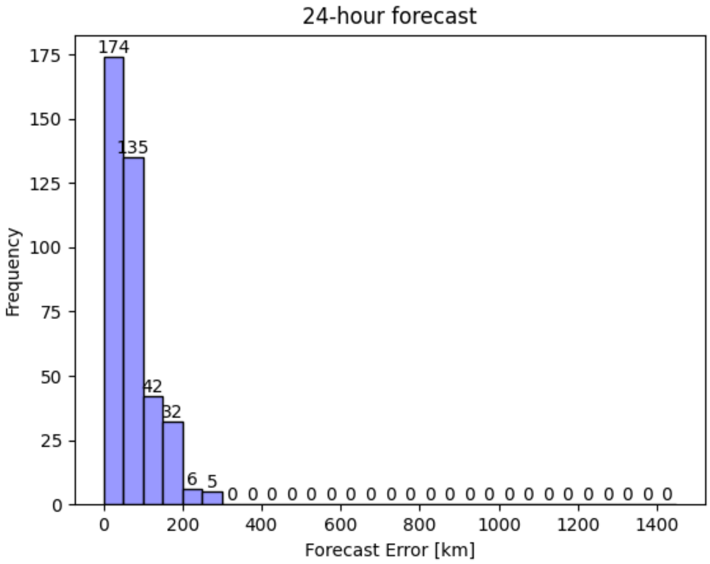


Figure 4.3 Histogram of 24-hour forecast position errors in 2024 (Histograms for 48-, 72-, 96- and 120-hour forecasts are available in Appendix 5 Figure A5.1 and A5.2)

Figure 4.3 shows a histogram of 24-hour forecast position errors (histograms for 48-, 72-, 96- and 120-hour forecasts are available in Appendix 5 Figure A5.1 and A5.2). About 89% (95% in 2023) of 24-hour forecasts, 96% (95%) of 48-hour forecasts, 98% (97%) of 72-hour forecasts, 91% (89%) of 96-hour forecasts and 80% (82%) of 120-hour forecasts had errors of less than 150, 300, 450, 500 and 600 km, respectively.

Figure 4.4 shows scatter diagrams of 48-hour forecast position errors in longitudinal/latitudinal direction and cross-track/along-track direction (Scatter diagrams of 24-, 72-, 96- and 120-hour forecasts are available in Appendix 5 Figure A5.3 and A5.4). While mean position biases are relatively small, fast bias for Shanshan (2410) during and after recurvature and northward bias for Man-yi (2424) before recurvature are seen.

Table 4.2 presents the mean hitting ratios and radii of 70% probability circles[7] provided in operational forecasts for each named TC that formed in 2024. The term hitting ratio here is used to describe the ratio of the number of 70% probability circles within which the actual TC center fell to the total number of circles. The annual mean radius of circles provided in 24-hour position forecasts was 92 km (86 km in 2023), and their hitting ratio was 75% (80%). The corresponding values for 48-hour forecasts were 160 km (148 km in 2023) and 81% (76%), those for 72-hour forecasts were 230 km (217 km in 2023) and 78% (75%), those for 96-hour forecasts were 291 km (284 km in 2023) and 69% (68%), and those for 120-hour forecasts were 372 km (370 km in 2023) and 62% (61%).

[7] Probability circle: a circular range in which a TC is expected to be located with a probability of 70% at each forecast period

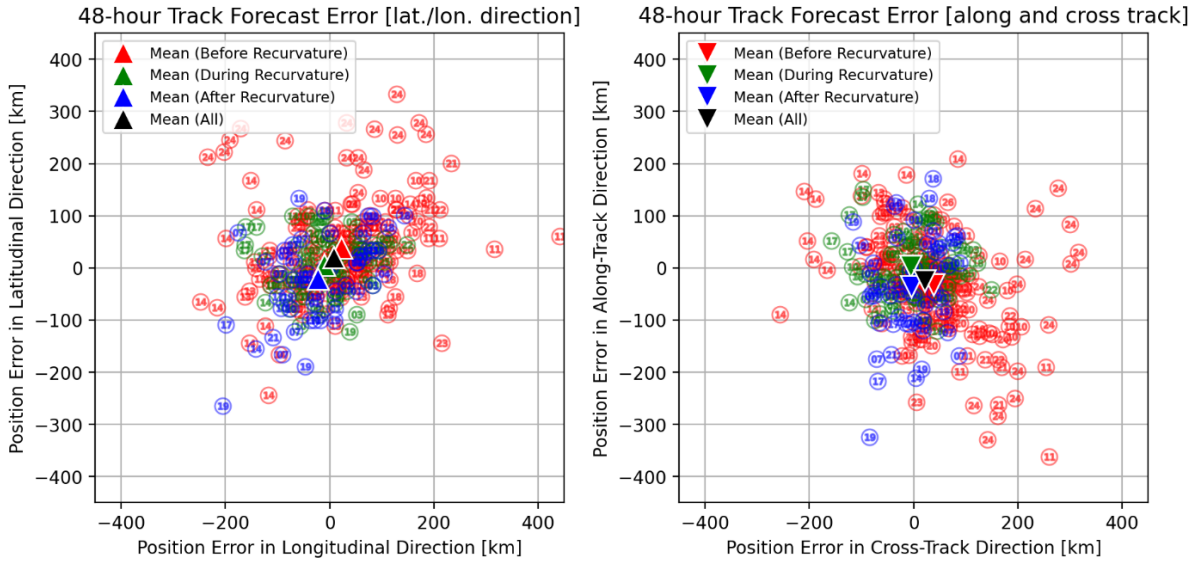


Figure 4.4 Scatter diagrams of 48-hour forecast position errors in longitudinal/latitudinal direction (left) and cross-/along-track direction (right) in 2024. (Scatter diagrams of 24-, 72-, 96- and 120-hour forecasts are available in Appendix 5 Figure A5.3 and A5.4.) Red, green and blue circles with TC numbers denote biases for each initial time in the stages before, during and after recurvature, respectively. Red, green and blue triangles indicate mean biases in the stages before, during and after recurvature, respectively. The definition of the stages is based on the direction of movement of each TC at individual prediction times (Figure 4.5). Black triangles indicate mean bias for all initial time.

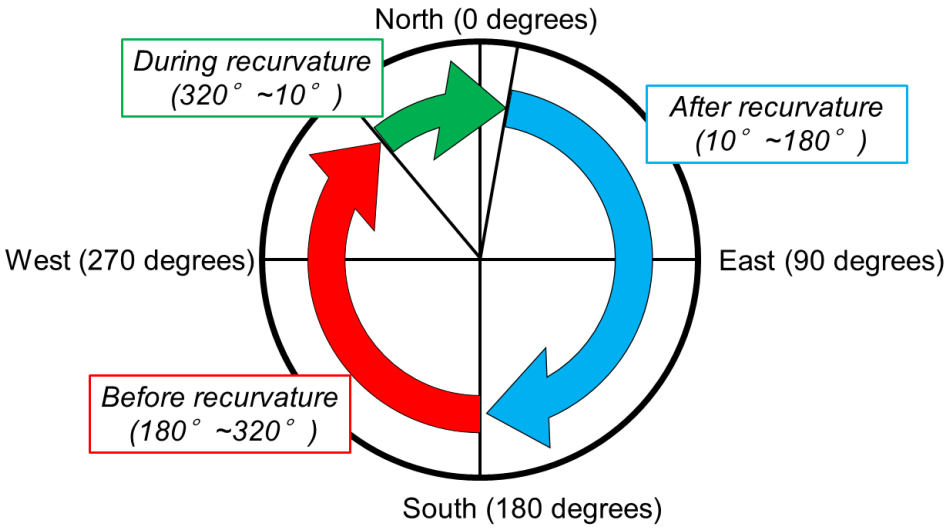


Figure 4.5 Definition of the stages before, during and after recurvature based on TC direction as calculated from positions at individual prediction times and those observed six hours prior.

Table 4.2 Mean hitting ratios (%) and radii (km) of 70% probability circles provided in 24-, 48-, 72-, 96- and 120-hour operational forecasts for each named TC that formed in 2024. Num. represents the number of samples.

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)
TY	Ewiniar	(2401)	94	17	96	100	13	177	100	9	264	100	5	332	100	1	519
TS	Maliksi	(2402)	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
TY	Gaemi	(2403)	78	23	97	100	19	173	100	15	254	91	11	306	71	7	382
STS	Prapiroon	(2404)	67	6	86	100	2	148	-	0	-	-	0	-	-	0	-
STS	Maria	(2405)	100	14	89	100	10	163	100	6	265	50	2	324	-	0	-
TS	Son-tinh	(2406)	100	6	102	100	2	185	-	0	-	-	0	-	-	0	-
TY	Ampil	(2407)	64	22	76	78	18	130	86	14	208	100	10	292	100	6	372
TS	Wukong	(2408)	0	2	97	-	0	-	-	0	-	-	0	-	-	0	-
TS	Jongdari	(2409)	100	5	81	100	1	157	-	0	-	-	0	-	-	0	-
TY	Shanshan	(2410)	81	31	90	74	27	163	57	23	237	16	19	309	0	15	398
TY	Yagi	(2411)	60	25	80	62	21	141	76	17	221	69	13	311	78	9	439
TS	Leepi	(2412)	0	1	78	-	0	-	-	0	-	-	0	-	-	0	-
TY	Bebinca	(2413)	91	22	99	100	18	191	100	14	283	100	10	357	100	6	431
TS	Pulasan	(2414)	47	19	116	62	13	202	33	9	276	0	3	309	0	2	398
TS	Soulik	(2415)	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
TS	Cimaron	(2416)	100	1	93	-	0	-	-	0	-	-	0	-	-	0	-
TY	Jebi	(2417)	61	18	113	93	14	209	90	10	282	100	6	343	100	2	491
TY	Krathon	(2418)	89	18	84	71	14	140	30	10	207	17	6	278	0	2	333
TS	Barijat	(2419)	50	12	115	88	8	204	100	4	294	-	0	-	-	0	-
STS	Trami	(2420)	75	20	99	81	16	166	67	12	228	75	8	278	75	4	366
TY	Kong-rey	(2421)	70	27	87	83	23	137	89	19	191	67	15	254	45	11	318
TY	Yinxing	(2422)	90	31	82	89	27	143	87	23	204	68	19	269	73	15	345
TY	Toraji	(2423)	88	17	70	85	13	119	100	9	161	80	5	213	100	1	278
TY	Man-yi	(2424)	58	38	97	56	34	160	63	30	220	88	17	256	85	13	321
TY	Usagi	(2425)	92	13	76	100	9	139	100	5	215	100	1	324	-	0	-
TS	Pabuk	(2426)	67	6	117	100	2	204	-	0	-	-	0	-	-	0	-
Annual Mean (Total)			75	394	92	81	304	160	78	229	230	69	150	291	62	94	372

4.1.2 Central Pressure and Maximum Wind Speed

Figure 4.6 shows annual means of root mean square errors (RMSEs) for TC central pressure and maximum wind speed forecasts covering periods of 24 hours, 48 hours (since 2001), 72 hours (since 2003) 96 hours and 120 hours (since 2019). The values for maximum wind speed forecasts for individual TCs are available in Appendix 5 Table A5.1.

Operational TC intensity forecasts have improved with the introduction of intensity forecast guidance, but no change trend has been seen in recent years. The annual RMSEs of central pressure for 24-, 48-, 72- 96- and 120-hour forecasts were 10.9 hPa (12.8 hPa in 2023), 13.4 hPa (16.9 hPa), 16.5 hPa (18.0 hPa), 20.4 hPa (20.6 hPa) and 23.8 hPa (22.2 hPa), respectively. The corresponding values for maximum wind speed were 5.3 m/s (5.1 m/s in 2023), 6.2 m/s (7.2 m/s), 7.3 m/s (7.9 m/s), 8.6 m/s (9.2 m/s) and 10.5 m/s (10.4 m/s), respectively. 48-hour forecast errors in 2024 were the lowest on record for both central pressure and maximum wind speed, while 120-hour forecast errors were the worst on record.

Figure 4.7 shows annual mean improvement ratios for central pressure and maximum wind speed forecasts in relation to a guidance model based on climatology and persistence (Statistical Hurricane Intensity Forecast; SHIFOR[8]) to highlight operational forecast skill. The values are defined as

$$\frac{\mathrm{RMSE(SHIFOR)} - \mathrm{RMSE(Operational)}}{\mathrm{RMSE(SHIFOR)}}$$

with positive/negative values indicating better/worse operational forecasts than SHIFOR predictions. It can be seen that the operational TC intensity forecasts have improved recently, with minimal year-to-year fluctuations. The annual mean improvement ratios of central pressure for 24-, 48-, 72-, 96- and 120-hour forecasts were 27% (13% in 2023), 44% (18%), 37% (12%), 14% (-6%) and -4% (-9%), respectively. The corresponding values of maximum wind speed were 17% (17% in 2023), 37% (26%), 36% (30%), 24% (22%) and 2% (14%), respectively. The ratios for 48-hour forecast in 2024 were the highest on record for both.

The details of errors in operational central pressure forecasts, including improvement ratios to SHIFOR for each named TC that formed in 2024, are summarized in Table 4.3. The data for maximum wind speed forecasts are available in Appendix 5 Table A5.1. Forecasts for Yagi (2411) and Kong-rey (2421) were characterized by large errors attributed to the difficulty of estimation for track and rapid intensification and weaking.

Figure 4.8 shows a histogram of maximum wind speed errors for 24-hour forecasts (Histograms for 48-, 72-, 96- and 120-hour forecasts are also available in Appendix 5 Figure A5.7 and A5.8). Approximately 58% (56% in 2023) of 24-hour forecasts had errors of less than ±3.75 m/s, with figures of ±6.25 m/s for 74% (63%) of 48-hour forecasts, ±6.25 m/s for 70% (59%) of 72-hour forecasts, ±8.75 m/s for 71% (66%) of 96-hour forecasts and ±8.75 m/s for 67% (60%) of 120-hour forecasts. The histograms of central pressure errors are also available in Appendix 5 Figure A5.5 and A5.6.

[8] The Center operates the SHIFOR model based on Jarvinen and Neumann (1979). The explanatory variables include TC analysis data (center position, central pressure and maximum sustained wind speed, and related temporal variation from best track data) and date. Multiple regression coefficients for the model were generated from best track data for named TCs forming between 1977 and 2010.

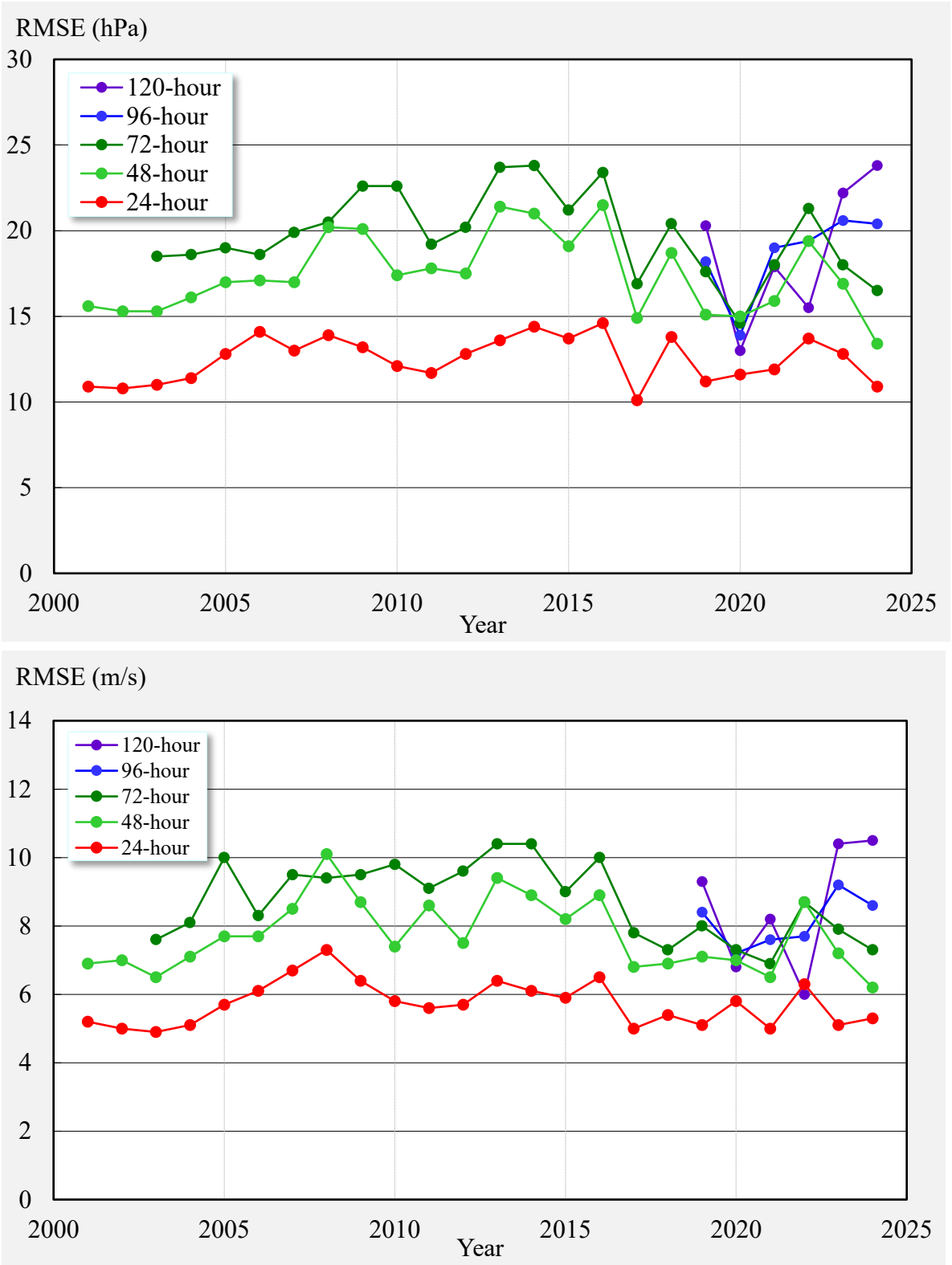
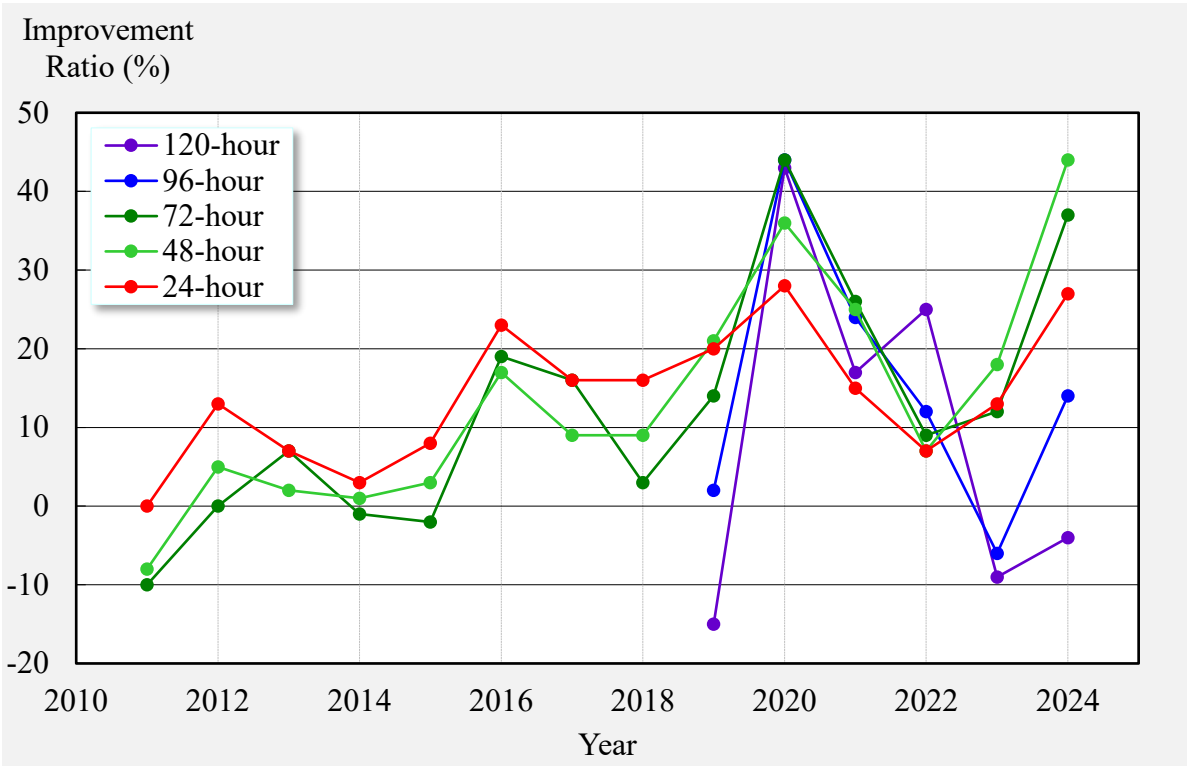


Figure 4.6 Annual RMSEs in 24-, 48, 72-, 96- and 120-hour operational central pressure (top) and maximum wind speed (bottom) forecasts



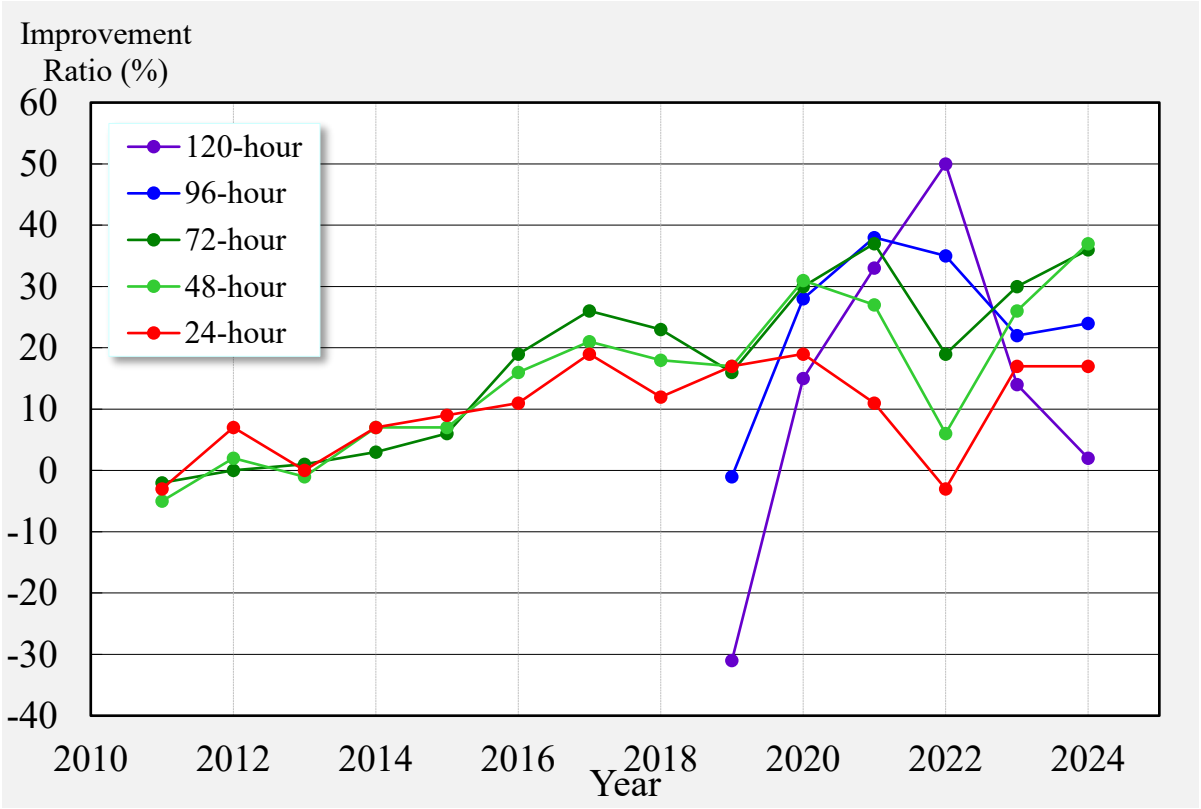


Figure 4.7 Annual mean improvement ratios in 24-, 48, 72-, 96- and 120-hour operational central pressure (top) and maximum wind speed (bottom) forecasts

Table 4.3 Mean errors of 24-, 48-, 72-, 96- and 120-hour operational central pressure forecasts for each named TC that formed in 2024. Num. and Impr. represent the number of samples and improvement ratio of RMSEs (see the equation in 4.1.2 for detail), respectively.

Tropical Cyclone			24-hour Forecast				48-hour Forecast				72-hour Forecast				96-hour Forecast				120-hour Forecast			
			Error (hPa)	RMSE (hPa)	Num.	Impr. (%)	Error (hPa)	RMSE (hPa)	Num.	Impr. (%)	Error (hPa)	RMSE (hPa)	Num.	Impr. (%)	Error (hPa)	RMSE (hPa)	Num.	Impr. (%)	Error (hPa)	RMSE (hPa)	Num.	Impr. (%)
TY	Ewiniar	(2401)	4.2	13.9	17	-56	-2.8	13.3	13	22	-2.1	7.8	9	66	-2.8	3.9	5	85	-4.0	4.0	1	88
TS	Maliksi	(2402)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Gaemi	(2403)	-1.0	5.1	23	68	-0.4	10.4	19	40	-0.9	12.2	15	20	-8.5	22.0	11	-29	-24.0	27.1	7	-54
STS	Prapiroon	(2404)	6.2	7.5	6	15	9.0	9.1	2	48	-	-	0	-	-	-	0	-	-	-	0	-
STS	Maria	(2405)	-4.1	8.1	14	-16	-3.7	6.7	10	23	-2.0	5.7	6	-135	-1.0	6.1	2	38	-	-	0	-
TS	Son-tinh	(2406)	-1.3	3.1	6	57	7.0	7.1	2	63	-	-	0	-	-	-	0	-	-	-	0	-
TY	Ampil	(2407)	-0.7	6.4	22	45	1.9	4.6	18	74	9.6	11.6	14	45	14.5	15.9	10	8	14.0	14.2	6	-100
TS	Wukong	(2408)	0.0	0.0	2	100	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TS	Jongdari	(2409)	-0.8	3.8	5	50	-4.0	4.0	1	80	-	-	0	-	-	-	0	-	-	-	0	-
TY	Shanshan	(2410)	-6.3	15.5	31	11	-8.4	17.4	27	36	-8.0	20.1	23	23	2.4	20.6	19	3	17.3	24.1	15	-30
TY	Yagi	(2411)	7.4	19.6	25	17	18.8	25.9	21	31	26.2	35.1	17	12	24.4	37.4	13	-3	13.3	28.6	9	-6
TS	Leepi	(2412)	2.0	2.0	1	56	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Bebinca	(2413)	-3.8	7.1	22	41	-4.2	10.5	18	44	-3.4	8.4	14	58	2.8	4.1	10	79	2.7	7.3	6	73
TS	Pulasan	(2414)	0.6	1.9	19	78	0.5	1.7	13	93	-0.4	1.3	9	97	-3.3	3.5	3	93	-1.0	1.4	2	97
TS	Soulik	(2415)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TS	Cimaron	(2416)	4.0	4.0	1	-111	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Jebi	(2417)	1.3	6.2	18	35	0.4	5.0	14	73	3.2	6.0	10	72	11.5	12.6	6	26	8.5	8.9	2	65
TY	Krathon	(2418)	2.3	17.3	18	4	7.9	22.8	14	27	18.0	23.8	10	26	3.3	16.1	6	14	-10.0	10.0	2	21
TS	Barijat	(2419)	0.4	3.0	12	49	1.6	4.3	8	69	1.8	2.7	4	86	-	-	0	-	-	-	0	-
STS	Trami	(2420)	-1.6	5.0	20	59	-2.8	4.8	16	67	-7.9	10.2	12	40	-6.3	9.5	8	44	-8.8	11.1	4	52
TY	Kong-rey	(2421)	0.1	12.9	27	18	0.7	12.6	23	50	2.7	15.1	19	37	3.5	25.7	15	-8	-0.5	37.2	11	-55
TY	Yinxing	(2422)	1.6	6.7	31	58	5.0	9.8	27	39	6.7	14.0	23	-9	3.5	8.2	19	36	2.9	4.3	15	67
TY	Toraji	(2423)	-1.2	4.3	17	59	-0.6	2.8	13	86	-0.7	2.4	9	91	-0.8	3.8	5	87	-2.0	2.0	1	94
TY	Man-yi	(2424)	4.5	12.4	38	28	7.4	13.3	34	58	10.5	17.5	30	50	20.9	28.3	17	7	17.4	33.0	13	-7
TY	Usagi	(2425)	-1.5	17.1	13	38	2.9	22.6	9	23	-9.8	11.7	5	57	-8.0	8.0	1	77	-	-	0	-
TS	Pabuk	(2426)	-1.7	2.4	6	68	-4.0	4.0	2	81	-	-	0	-	-	-	0	-	-	-	0	-
Annual Mean (Total)			0.3	10.9	394	27	1.9	13.4	304	44	3.9	16.5	229	37	6.1	20.4	150	14	5.6	23.8	94	-4

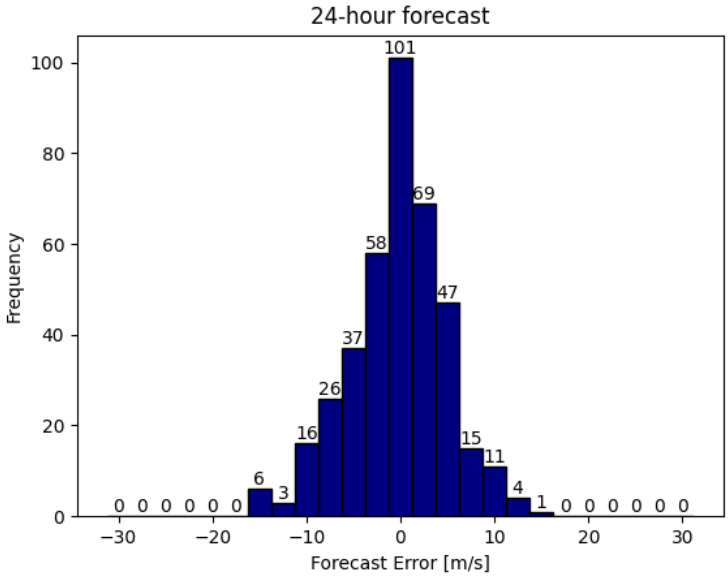


Figure 4.8 Histogram of 24-hour forecast maximum wind speed errors in 2024 (Histograms for 48-, 72-, 96- and 120-hour forecasts are also available in Appendix 5 Figure A5.7 and A5.8).

[Reference]

Aberson, S. D., 1998. Five-day tropical cyclone track forecasts in the North Atlantic basin, *Weather and Forecasting*, **13**, 1005-1015.

Jarvinen, B. R. and C. J. Neumann, 1979: Statistical forecasts of tropical cyclone intensity, *NOAA Tech. Memo. NWS NHC-10*, 22 pp.

Neumann, C. J., 1972: An alternate to the Hurran (hurricane analog) tropical cyclone forecasting system. *NOAA Tech. Memo. NWS SR 62*, 23 pp.

Merrill, R. T., 1980: A statistical tropical cyclone motion forecasting system for the Gulf of Mexico. *NOAA Tech. Memo. NWS NHC 14*, 21 pp.

4.2 Verification of Timing of First-issued Operational Forecasts

The Center issues TC track forecasts with probability circles and intensity forecasts when a TC of TS intensity or higher is present or expected within 24 hours in its area of responsibility. Accordingly, initial forecasts for individual TCs are also used as 24-hour genesis forecasts in addition to track and intensity forecasts.

Table 4.4 shows differences between initial times of first forecast and upgrade times in best track data/real-time provisional analysis data for individual named TCs in 2024. In several cases, differences were shorter than the ideal for 24 hours due to sub-optimal numerical model prediction.

Table 4.4 Lead times of operational forecasting for upgrade to TS intensity or higher. "First forecast", "Upgrade (Best/Prov.)" and "Lead time (Best/Prov.)" are the initial time of the first forecast for individual named TCs, the time when the TC was upgraded to TS intensity or higher in best track data/provisional analysis, and the time difference between the two, respectively.

Tropical Cyclone			First Forecast	Upgrade (Best)	Upgrade (Prov.)	Lead Time (Best)	Lead Time (Prov.)
TY	Ewiniar	(2401)	00UTC 23 May	12UTC 25 May	00UTC 26 May	60 h	72 h
TS	Maliksi	(2402)	06UTC 30 May	00UTC 31 May	06UTC 31 May	18 h	24 h
TY	Gaemi	(2403)	12UTC 19 Jul	00UTC 20 Jul	06UTC 20 Jul	12 h	18 h
STS	Prapiroon	(2404)	06UTC 19 Jul	00UTC 21 Jul	03UTC 21 Jul	42 h	45 h
STS	Maria	(2405)	12UTC 06 Aug	18UTC 07 Aug	18UTC 07 Aug	30 h	30 h
TS	Son-tinh	(2406)	12UTC 10 Aug	00UTC 11 Aug	09UTC 11 Aug	12 h	21 h
TY	Ampil	(2407)	00UTC 12 Aug	12UTC 12 Aug	18UTC 12 Aug	12 h	18 h
TS	Wukong	(2408)	00UTC 13 Aug	00UTC 13 Aug	06UTC 13 Aug	0 h	6 h
TS	Jongdari	(2409)	18UTC 18 Aug	12UTC 18 Aug	18UTC 18 Aug	-6 h	0 h
TY	Shanshan	(2410)	00UTC 21 Aug	18UTC 21 Aug	18UTC 21 Aug	18 h	18 h
TY	Yagi	(2411)	00UTC 01 Sep	06UTC 01 Sep	12UTC 01 Sep	6 h	12 h
TS	Leepi	(2412)	06UTC 05 Sep	00UTC 05 Sep	06UTC 05 Sep	-6 h	0 h
TY	Bebinca	(2413)	18UTC 09 Sep	12UTC 10 Sep	12UTC 10 Sep	18 h	18 h
TS	Pulasan	(2414)	06UTC 15 Sep	12UTC 15 Sep	12UTC 15 Sep	6 h	6 h
TS	Soulik	(2415)	00UTC 16 Sep	18UTC 18 Sep	00UTC 19 Sep	66 h	72 h
TS	Cimaron	(2416)	00UTC 25 Sep	06UTC 24 Sep	03UTC 25 Sep	-18 h	3 h
TY	Jebi	(2417)	06UTC 26 Sep	00UTC 27 Sep	06UTC 27 Sep	18 h	24 h
TY	Krathon	(2418)	18UTC 26 Sep	00UTC 28 Sep	00UTC 28 Sep	30 h	30 h
TS	Barijat	(2419)	00UTC 07 Oct	06UTC 06 Oct	06UTC 09 Oct	-18 h	54 h
STS	Trami	(2420)	06UTC 20 Oct	18UTC 21 Oct	18UTC 21 Oct	36 h	36 h
TY	Kong-rey	(2421)	00UTC 24 Oct	18UTC 24 Oct	21UTC 24 Oct	18 h	21 h
TY	Yinxing	(2422)	00UTC 03 Nov	12UTC 03 Nov	18UTC 03 Nov	12 h	18 h
TY	Toraji	(2423)	18UTC 08 Nov	06UTC 09 Nov	06UTC 09 Nov	12 h	12 h
TY	Man-yi	(2424)	00UTC 09 Nov	18UTC 08 Nov	06UTC 09 Nov	-6 h	6 h
TY	Usagi	(2425)	00UTC 10 Nov	18UTC 11 Nov	18UTC 11 Nov	42 h	42 h
TS	Pabuk	(2426)	00UTC 22 Dec	06UTC 22 Dec	06UTC 23 Dec	6 h	30 h

4.3 Verification of Numerical Models (GSM, GEPS)

GSM and GEPS provide primary information for use by JMA forecasters in making operational TC track and intensity forecasts. The details of GSM and GEPS and information on recent related improvements are given in Appendix 7. GSM and GEPS predictions were verified with RSMC TC best track data and predictions using the persistency (PER) method. All TC forecast verifications were conducted for both systems.

4.3.1 GSM Prediction

1) Center Position

GSM annual mean position errors observed since 1997 are presented in Figure 4.9. In 2024, the annual mean errors for 30-, 54-, 78-, 102- and 126-hour[9] predictions were 94 km (85 km in 2023), 146 km (144 km), 224 km (225 km), 367 km (337 km) and 587 km (466 km), respectively. The mean position errors of 18-, 30-, 42-, 54-, 66-, 78-, 90-, 102-, 114- and 126-hour predictions for each named TC are given in Table 4.5.

Table 4.6 shows relative GSM performance compared with results obtained using the PER method[10]. In this comparison, TCs were classified into the three life stages of before, during, and after recurvature. The definition of the stages is based on the direction of movement of each TC at individual prediction times (Figure 4.5). The table indicates that GSM results outperformed those of the PER method throughout the forecast period beyond 18 hours from the initial time, and that the ratios of error reduction for the GSM compared to the PER method were about 59% (52% in 2023), 69% (64%), 76% (70%), 76% (69%), 71% (65%) and 63% (62%) for 18-, 30-, 54-, 78-, 102- and 126-hour predictions, respectively.

About 81% (87% in 2023) of 30-hour predictions (histograms showing the position errors of 30-, 54-, 78-, 102- and 126-hour predictions are shown in Appendix 5 Figure A5.9 and A5.10) had errors of less than 150 km, while 92% (92%) of 54-hour predictions had errors of less than 300 km, and 93% (92%) of 78-hour predictions had errors of less than 450 km.

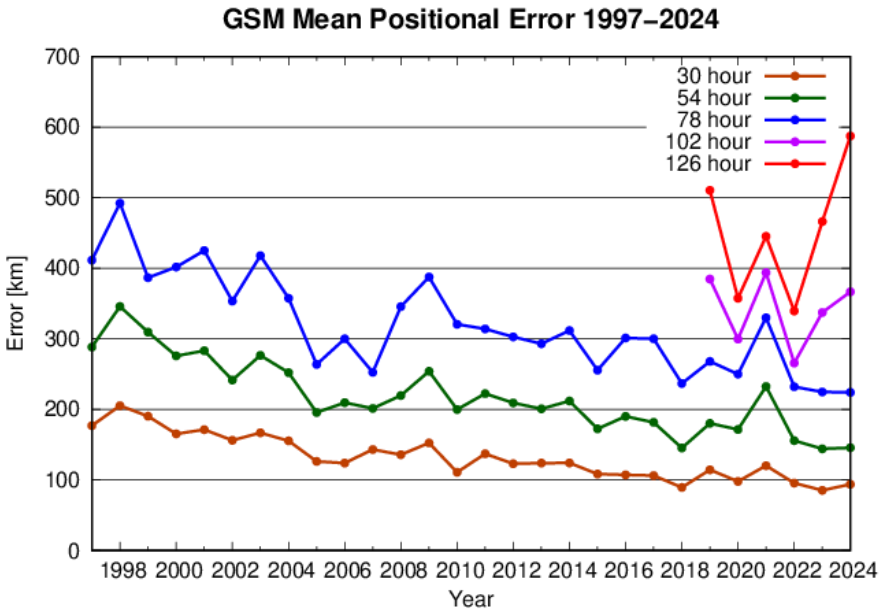


Figure 4.9 GSM annual mean position errors since 1997

[9] 30-, 54-, 78-, 102- and 126-hour GSM predictions are used as primary information by forecasters creating 24-, 48-, 72-, 96- and 120-hour operational forecasts, respectively.

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

Table 4.5 GSM mean position errors (km) for each named TC that formed in 2024. The number of samples is given in parentheses.

Tropical Cyclone			T=18		T=30		T=42		T=54		T=66		T=78		T=90		T=102		T=114		T=126	
TY	2401	EWINIAR	77.1	(25)	107.6	(23)	137.3	(21)	179.8	(19)	214.0	(17)	248.2	(15)	321.5	(13)	438.2	(11)	528.4	(9)	657.4	(7)
TS	2402	MALIKSI	33.0	(5)	93.6	(3)	144.5	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2403	GAEMI	101.9	(31)	112.1	(29)	122.6	(27)	124.4	(25)	142.6	(23)	162.5	(21)	182.0	(18)	226.7	(17)	312.9	(15)	357.6	(13)
STS	2404	PRAPIROON	67.1	(11)	94.6	(9)	130.2	(7)	196.8	(5)	264.4	(2)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
STS	2405	MARIA	58.0	(22)	74.7	(20)	81.2	(18)	93.5	(16)	108.9	(14)	138.5	(12)	163.0	(10)	243.8	(8)	466.4	(6)	1008.8	(4)
TS	2406	SON-TINH	61.9	(9)	102.3	(7)	187.4	(5)	245.3	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2407	AMPIL	49.7	(25)	63.0	(23)	86.2	(21)	106.6	(19)	123.6	(17)	163.0	(15)	209.7	(13)	246.0	(11)	318.1	(9)	320.8	(7)
TS	2408	WUKONG	106.3	(7)	155.2	(5)	242.5	(3)	283.1	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TS	2409	JONGDARI	49.6	(6)	42.8	(4)	55.5	(2)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2410	SHANSHAN	44.6	(42)	66.7	(40)	90.3	(38)	121.1	(36)	183.3	(34)	288.7	(32)	468.4	(30)	682.2	(28)	881.8	(24)	1201.3	(23)
TY	2411	YAGI	69.6	(26)	100.8	(24)	140.2	(22)	186.3	(20)	224.6	(18)	277.3	(16)	370.8	(14)	529.6	(12)	708.8	(10)	937.6	(8)
TS	2412	LEEPI	55.1	(9)	63.3	(5)	89.4	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2413	BEBINCA	70.4	(26)	100.2	(24)	141.1	(22)	163.7	(20)	203.0	(18)	247.6	(16)	298.1	(14)	353.0	(12)	372.7	(10)	379.5	(8)
TS	2414	PULASAN	108.2	(20)	121.9	(18)	167.5	(16)	225.0	(14)	288.5	(12)	415.3	(10)	577.0	(7)	748.4	(3)	888.7	(2)	-	(-)
TS	2415	SOULIK	177.0	(10)	177.9	(8)	185.2	(5)	259.1	(3)	480.0	(2)	666.0	(2)	-	(-)	-	(-)	-	(-)	-	(-)
TS	2416	CIMARON	59.9	(6)	60.4	(4)	116.8	(2)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2417	JEBI	79.8	(24)	106.5	(22)	127.2	(20)	139.0	(18)	144.3	(15)	122.0	(12)	127.1	(10)	163.3	(8)	199.3	(6)	275.1	(3)
TY	2418	KRATHON	55.2	(25)	95.4	(23)	123.0	(21)	153.4	(18)	212.8	(16)	271.6	(13)	359.0	(12)	475.6	(11)	548.1	(8)	676.2	(6)
TS	2419	BARIJAT	105.0	(18)	134.3	(16)	157.9	(14)	135.8	(12)	129.8	(10)	180.7	(8)	246.6	(6)	332.3	(4)	356.2	(1)	-	(-)
STS	2420	TRAMI	80.6	(25)	112.1	(25)	134.8	(22)	169.5	(21)	235.8	(19)	325.1	(17)	426.4	(15)	566.0	(13)	692.4	(12)	858.7	(10)
TY	2421	KONG-REY	81.7	(30)	98.3	(28)	109.0	(26)	112.1	(24)	119.8	(22)	140.2	(20)	170.9	(18)	201.0	(16)	261.5	(14)	353.3	(12)
TY	2422	YINXING	54.8	(34)	68.0	(32)	82.8	(30)	108.1	(28)	134.5	(26)	169.5	(24)	192.6	(22)	218.3	(20)	267.7	(18)	324.8	(16)
TY	2423	TORAJI	49.7	(21)	66.2	(19)	93.3	(16)	130.0	(14)	121.8	(11)	176.7	(9)	221.2	(7)	257.2	(5)	204.6	(3)	-	(-)
TY	2424	MAN-YI	67.1	(41)	95.3	(39)	133.1	(37)	166.7	(35)	196.7	(33)	216.3	(30)	228.6	(28)	241.5	(26)	248.0	(24)	240.6	(22)
TY	2425	USAGI	59.6	(20)	76.9	(18)	92.1	(16)	121.8	(14)	163.3	(12)	193.3	(10)	234.7	(8)	282.3	(6)	343.8	(4)	454.9	(2)
TS	2426	PABUK	86.2	(10)	106.7	(8)	179.5	(6)	285.3	(4)	224.1	(2)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
All	Annual	Mean	71.5	(528)	94.0	(476)	120.4	(419)	145.8	(367)	176.9	(323)	224.2	(282)	285.2	(245)	366.5	(211)	454.5	(175)	587.3	(141)

Table 4.6 Mean position errors (km) of GSM and PER method predictions for the 26 named TCs that formed in 2024 in the stages before, during and after recurvature. The number of samples is given in parentheses. IMPROV is the ratio of error reductions in GSM results to those observed using the PER method.

TIME	MODEL	Before		During		After		All	
T=18	GSM	77.9	(310)	58.3	(119)	67.5	(99)	71.5	(528)
	PER	170.4	(310)	167.9	(119)	196.1	(99)	174.7	(528)
	IMPROV	54.3	%	65.3	%	65.6	%	59.0	%
T=30	GSM	98.4	(277)	80.3	(109)	97.1	(90)	94.0	(476)
	PER	289.9	(277)	300.7	(109)	363.8	(90)	306.4	(476)
	IMPROV	66.1	%	73.3	%	73.3	%	69.3	%
T=42	GSM	128.3	(247)	94.4	(92)	125.5	(80)	120.4	(419)
	PER	428.3	(247)	446.9	(92)	528.7	(80)	451.5	(419)
	IMPROV	70.0	%	78.9	%	76.3	%	73.3	%
T=54	GSM	159.9	(211)	106.8	(84)	150.2	(72)	145.8	(367)
	PER	583.9	(211)	538.3	(84)	738.1	(72)	603.7	(367)
	IMPROV	72.6	%	80.2	%	79.7	%	75.9	%
T=66	GSM	187.5	(188)	138.4	(69)	187.0	(66)	176.9	(323)
	PER	736.7	(188)	714.0	(69)	863.8	(66)	757.8	(323)
	IMPROV	74.6	%	80.6	%	78.4	%	76.7	%
T=78	GSM	230.4	(166)	194.1	(55)	234.4	(61)	224.2	(282)
	PER	891.6	(166)	862.1	(55)	1051.0	(61)	920.4	(282)
	IMPROV	74.2	%	77.5	%	77.7	%	75.6	%
T=90	GSM	264.0	(144)	322.2	(43)	310.3	(58)	285.2	(245)
	PER	1032.2	(144)	1009.7	(43)	1227.8	(58)	1074.5	(245)
	IMPROV	74.4	%	68.1	%	74.7	%	73.5	%
T=102	GSM	326.6	(126)	424.2	(31)	426.5	(54)	366.5	(211)
	PER	1176.9	(126)	1134.8	(31)	1492.4	(54)	1251.5	(211)
	IMPROV	72.3	%	62.6	%	71.4	%	70.7	%
T=114	GSM	394.7	(108)	576.4	(20)	539.9	(47)	454.5	(175)
	PER	1290.4	(108)	1299.6	(20)	1811.3	(47)	1431.3	(175)
	IMPROV	69.4	%	55.6	%	70.2	%	68.3	%
T=126	GSM	487.6	(88)	888.5	(15)	699.2	(38)	587.3	(141)
	PER	1392.2	(88)	1558.4	(15)	2017.3	(38)	1578.4	(141)
	IMPROV	65.0	%	43.0	%	65.3	%	62.8	%

2) Central Pressure and Maximum Wind Speed

The mean errors of 30-, 54-, 78-, 102- and 126-hour GSM central pressure predictions in 2024 were +1.6 hPa (+0.4 hPa in 2023), +3.2 hPa (-0.5 hPa), +5.5 hPa (-1.8 hPa), +6.6 hPa (-1.6 hPa) and +5.6 hPa (-2.6 hPa), respectively. Their root mean square errors (RMSEs) were 12.8 hPa (15.3 hPa in 2023) for 30-hour predictions, 16.0 hPa (18.7 hPa) for 54-hour predictions, 19.6 hPa (23.8 hPa) for 78-hour predictions, 21.7 hPa (27.4 hPa) for 102-hour predictions and 23.9 hPa (27.5 hPa) for 126-hour predictions. The biases in 30-, 54-, 78-, 102- and 126-hour maximum wind speed predictions were -1.7 m/s (-0.4 m/s in 2023) with an RMSE of 8.2 m/s (8.1 m/s), -2.7 m/s (-0.4 m/s) with a RMSE of 9.9 m/s (10.0 m/s), -4.0 m/s (-0.4 m/s) with a RMSE of 11.0 m/s (12.2 m/s), -4.9 m/s (-1.5 m/s) with a RMSE of 12.1 m/s (13.3 m/s) and -4.9 m/s (-1.9 m/s) with a RMSE of 12.7 m/s (13.0 m/s), respectively.

Figure 4.10 shows histograms of central pressure errors and maximum wind speed errors in 30-hour GSM predictions. The GSM exhibited a small positive bias in central pressure prediction, and tended to underestimate the wind speed of TCs.

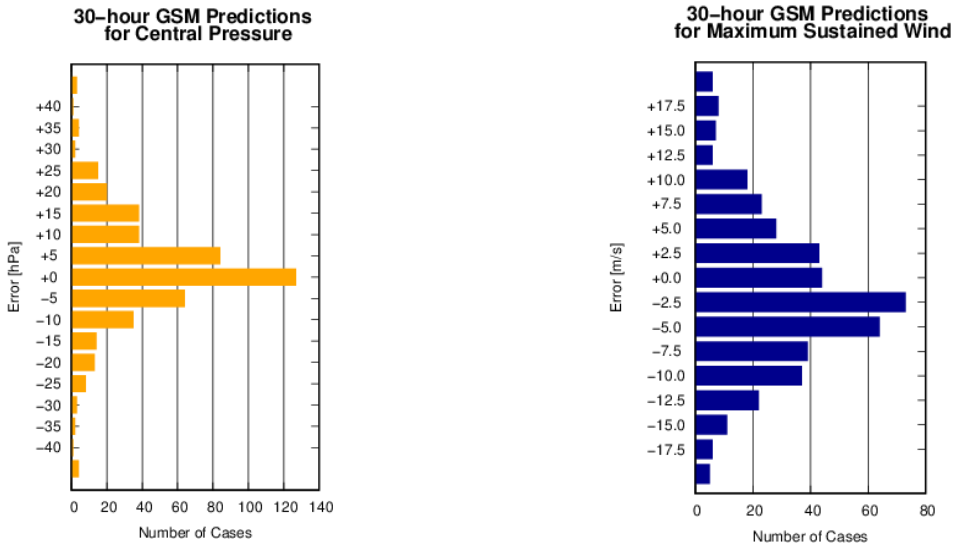


Figure 4.10 Error distribution of GSM 30-hour intensity predictions in 2024. The figure on the left shows error distribution for central pressure, while the one on the right shows that for maximum wind speed (the error distributions of 54-, 78-, 102- and 126-hour predictions are shown at the Appendix 5 Figure A5.11 and A5.12).

4.3.2 GEPS Prediction

1) Ensemble Mean Center Position

GEPS took over the role of the Typhoon Ensemble Prediction System (TEPS), and has been providing ensemble forecasts for TCs since January 2017. GEPS and TEPS annual mean position errors observed since 2008 are presented in Figure 4.11. In 2024, the mean position errors of GEPS ensemble mean forecasts for 18-, 30-, 42-, 54-, 66-, 78-, 90-, 102-, 114-, and 126-hour predictions for each named TC are given in Table 4.7. The annual means of ensemble mean position errors for 30-, 54-, 78-, 102- and 126-hour predictions were 105 km, 163 km, 250 km, 386 km and 607 km, respectively. These position errors of GEPS ensemble mean forecasts are larger than those of the GSM (see 4.3.1).

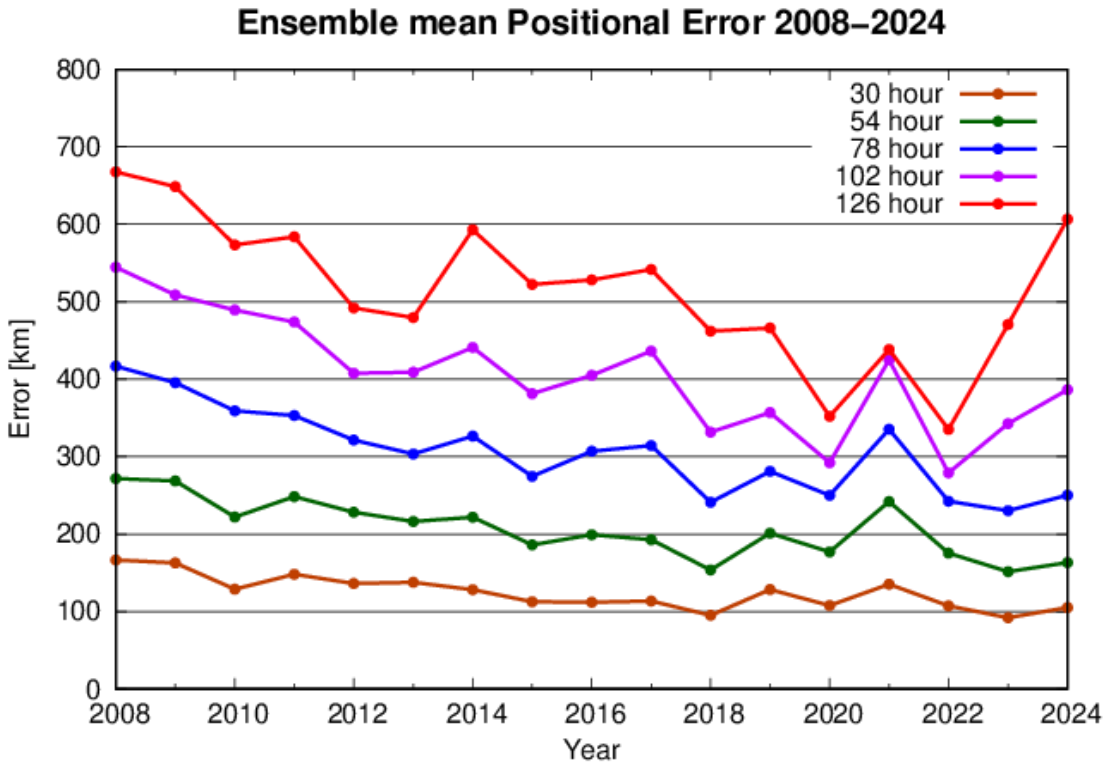


Figure 4.11 GEPS and TEPS annual mean position errors since 2008

Table 4.7 Mean position errors (km) of GEPS ensemble mean forecasts for each named TC that formed in 2024. The number of samples is given in parentheses.

Tropical Cyclone			T=18		T=30		T=42		T=54		T=66		T=78		T=90		T=102		T=114		T=126	
TY	2401	EWINIAR	80.1	(25)	118.5	(20)	130.7	(16)	139.9	(14)	137.6	(11)	171.8	(9)	224.1	(8)	260.4	(7)	360.9	(5)	519.1	(4)
TS	2402	MALIKSI	39.2	(5)	106.7	(3)	163.7	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2403	GAEMI	106.3	(31)	133.1	(29)	148.4	(27)	161.3	(25)	185.4	(23)	207.9	(21)	223.7	(19)	251.2	(17)	322.5	(15)	393.0	(13)
STS	2404	PRAPIROON	77.7	(11)	103.7	(9)	173.1	(6)	259.7	(4)	389.9	(1)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
STS	2405	MARIA	57.3	(22)	74.0	(20)	75.0	(18)	87.0	(16)	99.9	(14)	151.4	(12)	239.6	(10)	409.6	(8)	623.2	(6)	997.4	(4)
TS	2406	SON-TINH	63.3	(9)	97.6	(7)	167.1	(5)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2407	AMPIL	51.2	(25)	72.0	(23)	101.7	(21)	124.3	(19)	142.4	(17)	172.5	(15)	204.1	(13)	220.9	(11)	281.7	(9)	274.9	(7)
TS	2408	WUKONG	110.0	(6)	170.2	(4)	227.4	(3)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TS	2409	JONGDARI	39.2	(6)	38.5	(4)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2410	SHANSHAN	53.9	(42)	73.4	(40)	99.7	(38)	134.4	(36)	198.1	(34)	299.2	(32)	441.5	(30)	620.7	(28)	850.1	(26)	1080.2	(24)
TY	2411	YAGI	84.1	(26)	121.7	(24)	169.3	(22)	221.2	(20)	278.9	(18)	357.5	(16)	475.4	(14)	643.8	(12)	859.3	(10)	1126.4	(8)
TS	2412	LEEPI	59.7	(9)	67.5	(4)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2413	BEBINCA	73.0	(26)	104.4	(24)	127.3	(22)	148.2	(20)	175.7	(18)	203.3	(16)	249.1	(14)	309.0	(11)	335.9	(10)	351.9	(8)
TS	2414	PULASAN	103.5	(21)	119.3	(19)	138.7	(17)	182.5	(15)	225.7	(13)	340.5	(11)	453.3	(8)	575.9	(5)	606.0	(2)	708.6	(2)
TS	2415	SOULIK	183.6	(13)	177.1	(11)	178.8	(9)	316.6	(7)	516.6	(5)	776.1	(3)	1216.0	(1)	-	(-)	-	(-)	-	(-)
TS	2416	CIMARON	59.2	(6)	51.0	(4)	110.4	(2)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
TY	2417	JEBI	95.7	(24)	125.4	(22)	156.4	(20)	187.2	(17)	212.8	(15)	223.5	(13)	259.7	(10)	358.8	(6)	475.0	(4)	619.5	(3)
TY	2418	KRATHON	57.6	(25)	91.5	(23)	131.1	(21)	165.6	(19)	229.9	(17)	291.6	(15)	345.4	(13)	442.8	(11)	499.7	(9)	570.0	(7)
TS	2419	BARIJAT	107.5	(18)	150.2	(16)	177.1	(14)	166.4	(12)	171.0	(10)	248.2	(8)	406.2	(6)	618.3	(4)	805.1	(2)	-	(-)
STS	2420	TRAMI	95.1	(28)	121.4	(26)	158.2	(24)	196.2	(22)	255.5	(20)	325.8	(18)	416.3	(16)	530.4	(14)	671.8	(12)	853.4	(10)
TY	2421	KONG-REY	80.5	(31)	100.4	(29)	116.7	(27)	134.4	(25)	154.3	(23)	182.3	(21)	221.6	(19)	276.9	(17)	334.2	(15)	425.5	(13)
TY	2422	YINXING	64.2	(34)	89.6	(32)	110.7	(30)	145.8	(28)	174.4	(22)	205.3	(20)	208.6	(18)	228.3	(16)	277.2	(14)	373.0	(10)
TY	2423	TORAJI	59.3	(21)	90.4	(19)	128.8	(17)	167.1	(15)	200.5	(13)	224.8	(11)	246.5	(7)	235.8	(5)	177.5	(2)	-	(-)
TY	2424	MAN-YI	78.1	(41)	114.7	(37)	153.9	(36)	186.1	(34)	215.1	(32)	250.5	(30)	261.3	(27)	272.1	(24)	272.9	(22)	257.1	(20)
TY	2425	USAGI	59.8	(20)	80.7	(18)	112.0	(16)	133.9	(14)	170.0	(12)	230.6	(10)	273.7	(8)	311.8	(6)	349.1	(4)	414.1	(2)
TS	2426	PABUK	113.8	(10)	138.7	(8)	212.4	(6)	238.9	(4)	164.6	(2)	-	(-)	-	(-)	-	(-)	-	(-)	-	(-)
All	Annual	Mean	78.4	(535)	105.1	(475)	134.5	(418)	163.2	(366)	198.7	(320)	250.2	(281)	308.9	(241)	386.4	(202)	484.4	(167)	606.5	(135)

2) Spread-Skill Relationship

Although position errors of GEPS ensemble mean forecasts were larger than those of the GSM, GEPS provides useful information on the reliability of TC track forecasts with its ensemble spread. Figure 4.12 shows the relationship between 6-hourly cumulative ensemble spreads in TC position forecasts and ensemble mean forecast position errors in 126-hour prediction. In an ideal EPS with a large number of samples, significant positional errors are observed when the ensemble spread is large. The figure shows a weak positive correlation between ensemble spread and ensemble mean errors.

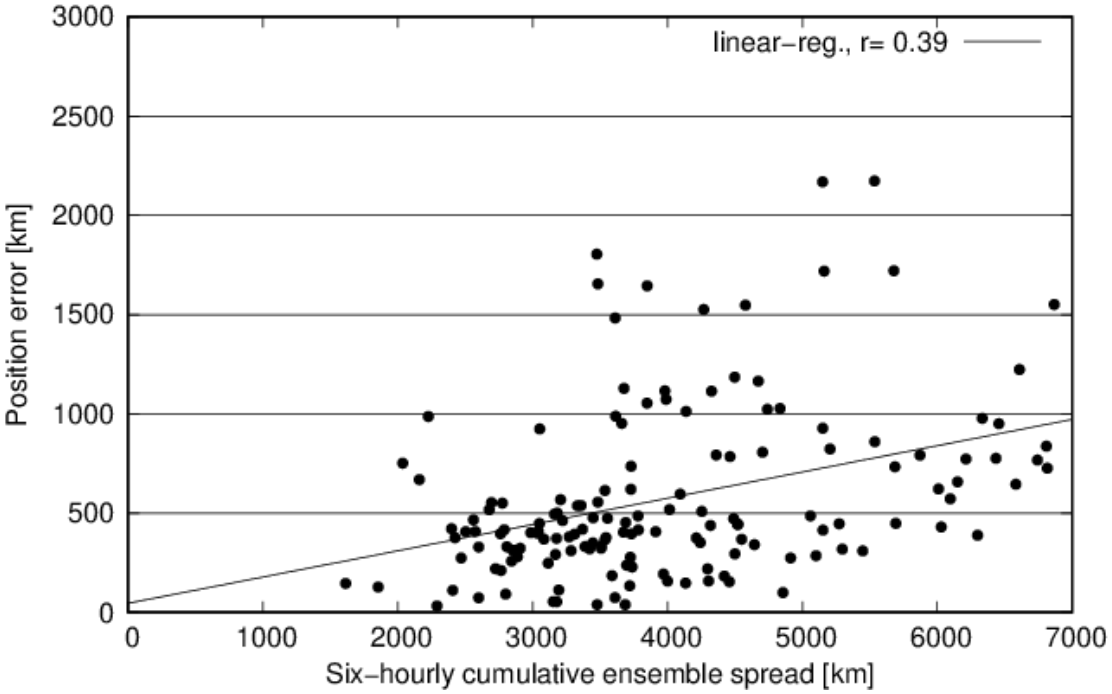


Figure 4.12 Relationship between six-hourly cumulative ensemble spread in TC position forecasts (km) and ensemble mean forecast position errors (km) in 126-hour predictions in 2024. The solid line represents a linear regression fit, with a correlation coefficient (r) of 0.39.

4.4 Verification for Other Guidance Models

4.4.1 Verification by WGNE

The Center utilizes other guidance models in addition to JMA's NWP models for operational TC track and intensity forecasting, including global deterministic NWP models from seven other centers (BOM, CMC, DWD, ECMWF, KMA, NCEP and UKMO). These models (as well as the Meteo France (FRN) model) are verified under the framework of WGNE (the Working Group on Numerical Experimentation), which is a collaborative working group for development of Earth system models (design, implementation, error diagnosis and model revision) across the full range of temporal and spatial scales. JMA works on inter-comparison of these models under this framework. Figures 4.13 and 4.14 show the results of the verification for center positions and 72-hour intensity forecasts by WGNE.

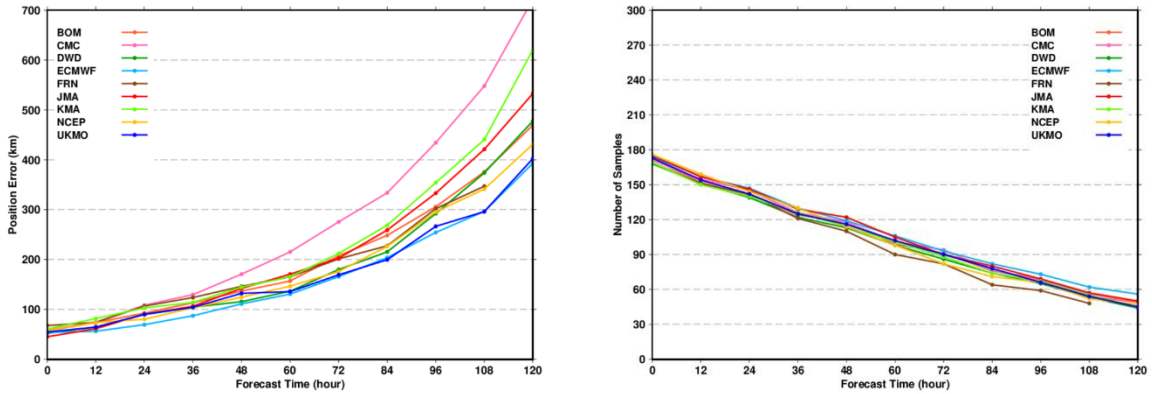


Figure 4.13 (Left) Positional errors for 2024 named TCs. The tropical depression (TD) stage and the extra-tropical cyclone (L) stage of targeted TCs is also included in this verification. (Right) Sample numbers.

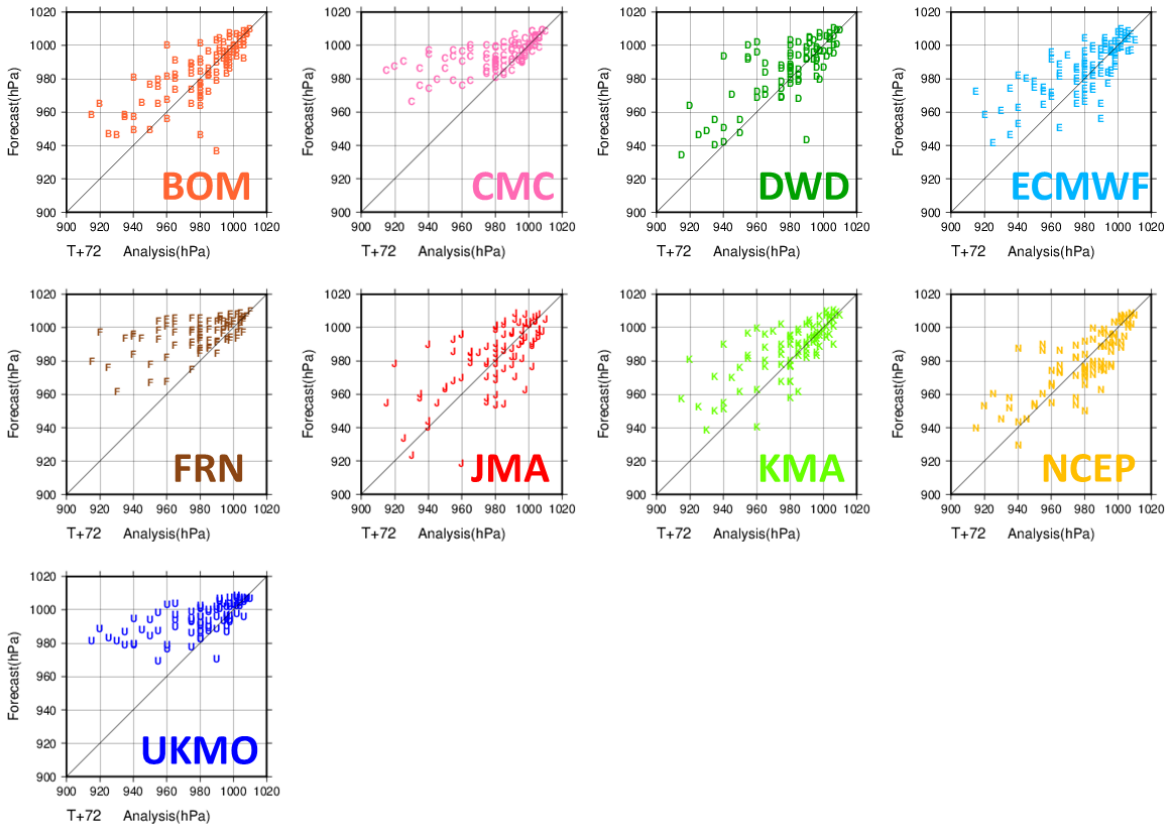


Figure 4.14 Scatter diagrams of 72-hour TC center pressure forecasts from nine deterministic models for 2024. The tropical depression (TD) stage and the extra-tropical cyclone (L) stage of targeted TCs are also included in this verification.

4.4.2 Verification of Intensity Guidance Models

Table 4.8 shows mean central pressure and maximum wind speed errors in TIFS and LGEM intensity guidance and related consensus. This section describes a verification of the latest guidance data available for each initial time of real-time operation conducted for RSMC operational forecasting.

Table 4.8 Mean errors and RMSEs of central pressure (top) and maximum wind speed (bottom) forecasts from intensity guidance models produced by the Center in 2024. Num. represents the number of samples.

Prediction		24-hour Forecast			48-hour Forecast			72-hour Forecast			96-hour Forecast			120-hour Forecast		
		Error (hPa)	RMSE (hPa)	Num.	Error (hPa)	RMSE (hPa)	Num.	Error (hPa)	RMSE (hPa)	Num.	Error (hPa)	RMSE (hPa)	Num.	Error (hPa)	RMSE (hPa)	Num.
Intensity guidance model	TIFS	-1.8	11.6	389	-2.9	14.9	297	-1.6	16.7	225	-1.6	18.5	154	-0.1	20.6	95
	LGEM	0.9	12.6	389	1.2	14.9	297	0.9	15.7	225	-1.8	18.7	154	-2.8	24.2	95
Consensus method	TIFS&LGEM	-0.5	11.6	389	-0.8	14.1	297	-0.4	15.7	225	-1.7	18.2	154	-1.4	21.9	95

Prediction		24-hour Forecast			48-hour Forecast			72-hour Forecast			96-hour Forecast			120-hour Forecast		
		Error (m/s)	RMSE (m/s)	Num.	Error (m/s)	RMSE (m/s)	Num.	Error (m/s)	RMSE (m/s)	Num.	Error (m/s)	RMSE (m/s)	Num.	Error (m/s)	RMSE (m/s)	Num.
Intensity guidance model	TIFS	-0.3	5.5	389	-0.1	7.0	297	-1.2	7.5	225	-2.0	8.4	154	-2.8	10.0	95
	LGEM	-0.7	5.9	389	-0.3	6.9	297	-0.6	7.4	225	-0.3	8.5	154	-0.3	10.8	95
Consensus method	TIFS&LGEM	-0.5	5.6	389	-0.2	6.9	297	-0.9	7.3	225	-1.1	8.3	154	-1.6	10.2	95

4.5 Verification of AMV-based Sea-surface Winds (ASWinds)

JMA produces Atmospheric Motion Vectors (AMVs) using successive satellite imagery from the Himawari-8/9 geostationary satellite. These are derived from the Full-disk observation conducted every 10 minutes and Region 3 tropical cyclone observation conducted over an area of 1,000 square kilometers every 2.5 – 5 minutes. Since July 2017, the Center has used the AMV-based Sea-surface Winds (ASWinds) product based on low-level AMVs (assigned below 700 hPa level) to estimate sea-surface winds in the vicinity of TCs. The ASWinds are derived at intervals of 10 – 30 minutes with frequent and wide-ranging wind distribution information. Figure 4.15 shows the distributions of ASWinds derived using the Full-disk and Region 3 observations by Himawari-9 for TY Shanshan (2410). The wide-area coverage and high temporal resolution of ASWinds data are also expected to support real-time determination of 30-kt wind radii for TC areas where low-level clouds appear in Himawari-8/9 imagery together with surface wind observations from satellite microwave scatterometers such as the ASCAT units on board MetOp polar-orbiting satellites (referred to here as "ASCAT winds").

The Center verified the quality of ASWinds data from Visible (B03: 0.64 μm) and Infrared (B13: 10.4 μm) with respect to ASCAT wind data in the vicinity of 26 TCs occurring in 2024 (Table 4.9). Wind speed biases in ASWinds data from Full-disk and Region 3 observation were small at -0.7 to -0.5 m/s, and -0.4 to -0.2 m/s, respectively. Vector differences in ASWinds from Region 3 observation were slightly larger than those from Full-disk observation, which suggested that the use of high-frequency Region-3 observation data supports tracking to determine the movement of low-level cloud associated with mesoscale phenomena.

The mean distribution of ASWinds data from Full-disk and Region-3 observation (Figure 4.16) for 2024 suggests that the representation of Region-3 ASWinds is higher than that of Full-disk ASWinds, particularly near TC centers. This is attributed to the higher temporal frequency of Region-3 imagery.

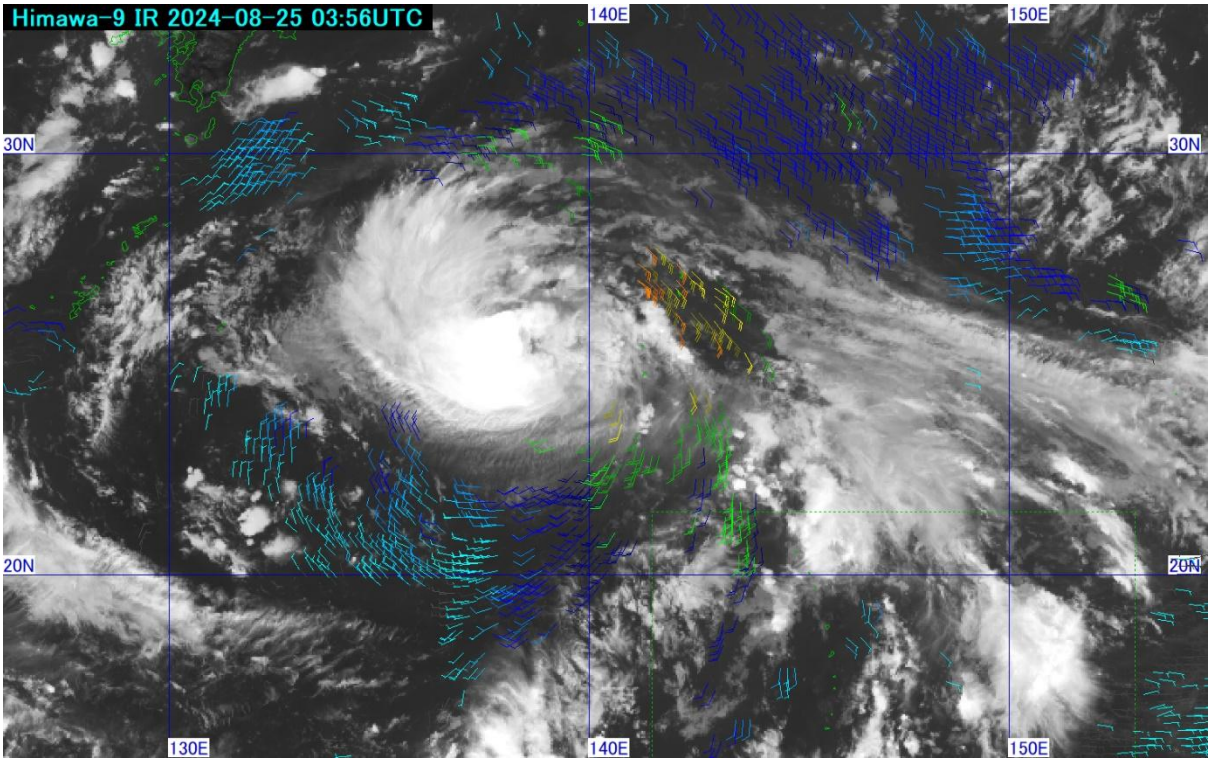


Figure 4.15 ASWinds derived from a series of Himawari-9 Full-disk and Region 3 Infrared (B13) images for TY Shanshan (2410) at 0356 UTC on 25 August 2024.

Table 4.9 Vector Differences and biases of ASWinds (0.85 < QI: Quality Indicator) with reference to ASCAT winds within a square of 20 degrees centered at the TC center for 26 TCs in 2024.

(a) ASWind (Full-disk)

	Number of collocations	Vector Difference [m/s]	Bias [m/s]
B03 (VIS)	378047	1.8	-0.5
B13 (IR)	324036	1.9	-0.7

(b) ASWind (Region 3)

	Number of collocations	Vector Difference [m/s]	Bias [m/s]
B03 (VIS)	846744	2.6	-0.2
B13 (IR)	740367	2.8	-0.4

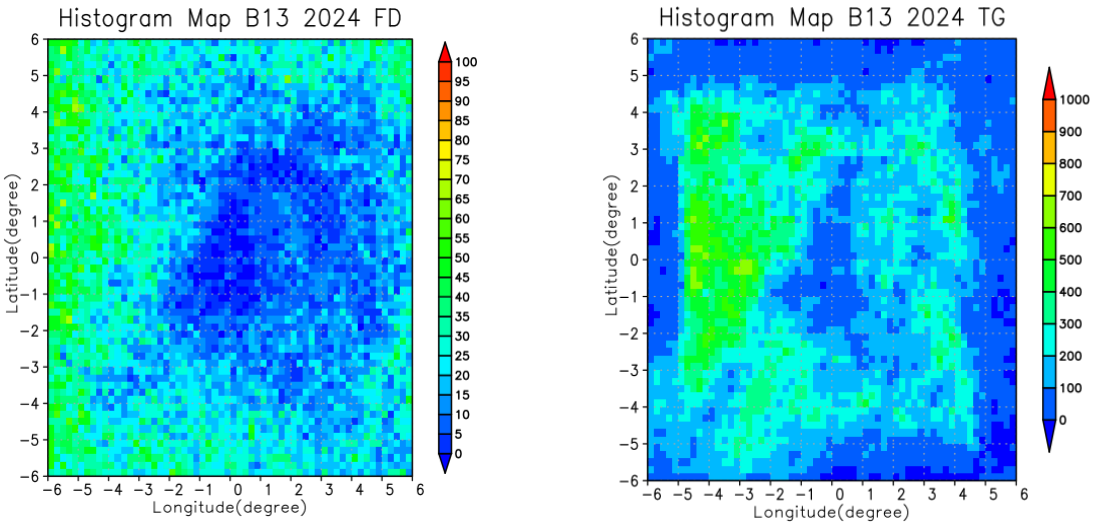


Figure 4.16 Spatial distributions of Full-disk (left) and Region 3 (right) ASWind data derived from Infrared (B13) images within a square of 12 degrees centered at TC center for 26 TCs in 2024.

4.6 Verification of TC Central Pressure Estimates Based on Satellite Microwave Observations

The Center uses TC central pressure (Minimum Sea Level Pressure, or MSLP) estimates based on TC warm core intensity (i.e., the maximum temperature anomaly near the TC center) from microwave sounders on board polar-orbiting satellites as reference for the Center operational TC analysis. The Advanced Microwave Sounding Unit-A (AMSU-A) of the NOAA and MetOp series of polar-orbiting satellites has been used for MSLP estimation since 2013. The Center also began to use data from the Advanced Technology Microwave Sounder (ATMS) on board the Suomi-NPP and JPSS-1 (NOAA-20) satellites in 2015. The higher spatial resolution of ATMS observation (32 km at the sub-satellite point) as compared to AMSU-A (48 km) enables more accurate determination of warm core intensity. Figure 4.17 shows the MSLP estimates based on AMSU-A and ATMS observations (referred to here as AMSU/ATMS estimates) together with MSLP estimates based on the Dvorak technique (Dvorak estimates) and a product based on consensus between AMSU/ATMS estimates and Dvorak estimates (CONSENSUS) for TY Ampil (2407).

Table 4.10 shows the results of AMSU and ATMS estimate verification with respect to JMA best track data for 2015 - 2024 together with Dvorak TC intensity estimates and CONSENSUS. The biases and root mean square errors (RMSEs) of AMSU estimates were -5.5 to 2.7 hPa and 8.9 to 14.0 hPa, respectively (Table 4.10a). It should be noted that the RMSE of CONSENSUS between AMSU estimates and Dvorak estimates is consistently smaller than that for AMSU and Dvorak estimates over a period of 10 years, which is attributed to the benefits of independent information from the satellite microwave observation. The RMSE for ATMS estimates was smaller than that for AMSU (Table 4.10b), which indicates that the higher resolution of ATMS observation as compared to AMSU leads to more accurate determination of TC warm core intensity. As with the AMSU estimate result, the RMSEs of CONSENSUS between ATMS and Dvorak estimates were smaller than those of ATMS and Dvorak estimates. The superiority of CONSENSUS to individual estimates is seen in bias comparison.

Use of AMSU/ATMS estimates via CONSENSUS is expected to support the Center’s operational TC intensity analysis, particularly when in-situ observation data are scarce and operational TC intensity analysis depends largely on the Dvorak estimates.

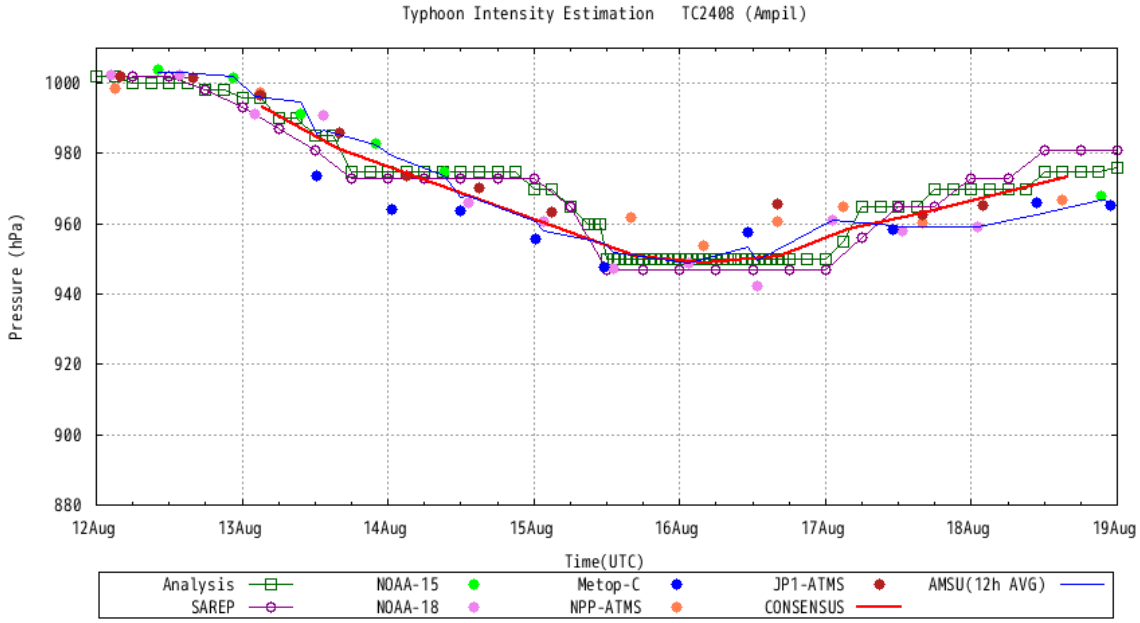


Figure 4.17 Time-series representation of Dvorak MSLP estimates, microwave-based MSLP estimates (AMSU and ATMS), CONSENSUS between Dvorak and AMSU/ATMS estimates and JMA analysis for TY Ampil (2407) on the Numerical Typhoon Prediction (NTP) website

Table 4.10 (a) Bias and RMSE of Dvorak MSLP estimates, AMSU MSLP estimates and CONSENSUS between Dvorak and AMSU estimates with respect to the best track data for the previous 10 years (2015 - 2024); (b) as per (a) but for ATMS estimates

(a) BIAS and RMSE of central pressure estimates to best track for AMSU

Year		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
BIAS	AMSU	1.3	2.7	-2.9	-3.1	-2.5	-5.5	-2.9	-1.9	-0.6	-0.4
(hPa)	Dvorak	0.1	-2.1	-2.0	-0.4	-2.9	-2.8	-2.1	-1.8	-0.3	-3.1
	Consensus	**0.3**	**-0.8**	**-2.6**	**-1.5**	**-3.2**	**-4.0**	**-2.8**	**-2.2**	**-0.8**	**-2.3**
RMSE	AMSU	12.8	13.8	10.0	12.4	11.7	14.0	13.1	11.3	12.6	8.9
(hPa)	Dvorak	7.5	9.6	7.2	7.0	9.2	8.4	7.9	6.5	8.6	9.0
	Consensus	**6.8**	**8.2**	**6.7**	**6.7**	**7.6**	**7.9**	**6.6**	**6.3**	**6.2**	**6.7**
Number of Data		819	595	569	680	645	478	703	473	398	470

(b) BIAS and RMSE of central pressure estimates to best track for ATMS

Year		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
BIAS	ATMS	3.0	4.1	1.8	0.9	1.9	0.9	1.7	1.1	2.9	1.9
(hPa)	Dvorak	-0.5	-1.4	-2.0	-0.9	-3.7	-3.6	-2.1	-2.7	-1.4	-1.4
	Consensus	**0.8**	**0.3**	**-0.7**	**-0.3**	**-1.9**	**-1.8**	**-0.9**	**-1.2**	**-0.1**	**-0.3**
RMSE	ATMS	11.9	13.0	8.7	11.4	9.9	9.0	10.9	8.1	11.8	8.1
(hPa)	Dvorak	7.8	8.5	7.9	7.9	9.7	9.6	8.5	8.0	8.3	8.2
	Consensus	**6.1**	**7.1**	**6.3**	**7.0**	**7.1**	**6.0**	**6.0**	**5.7**	**5.4**	**5.9**
Number of Data		229	190	193	224	244	148	159	116	136	139

4.7 Verification of Storm Surge Prediction

Storm surge predictions have been provided since 2011 via the Numerical Typhoon Prediction (NTP) website to Typhoon Committee Members within the framework of the Storm Surge Watch Scheme (SSWS). The Asia-area storm surge ensemble prediction system has been operational and probabilistic forecast products up to five days ahead have been provided since August 2022. For details of the system and the SSWS forecast products, refer to Hasegawa et al. (2023) on the NTP website. Verification of deterministic storm surge predictions was conducted on data from 10 stations (Table 4.11) for which sea level observation information is provided on the University of Hawaii Sea Level Center (UHSLC) database website (https://uhslc.soest.hawaii.edu/data/?fd) and the Global Sea Level Observing System (GLOSS) website (https://www.ioc-sealevelmonitoring.org/index.php) for all named TCs that formed in 2024. Hourly hindcast data (from T = -5 to T = 0) and forecast data (from T = 1 to T = 132) were compared with observation data. Ensemble predictions were also verified with information including data from the Shek Pik tide station (Hong Kong) for TY Yagi (2411).

Table 4.11 Stations used for verification

	Station	Abbreviation	Member	Data Source
1	Quarry Bay	QB	Hong Kong, China	UHSLC
2	Shek Pik	SP	Hong Kong, China	GLOSS
3	Langkawi	LK	Malaysia	UHSLC
4	Legaspi Port	LG	the Philippines	UHSLC
5	Manila South Harbor	ML	the Philippines	UHSLC
6	Subic Bay	SB	the Philippines	UHSLC
7	Quy Nhon	QN	Viet Nam	UHSLC
8	Vung Tau	VT	Viet Nam	UHSLC
9	Busan	BS	Republic of Korea	GLOSS
10	Apra Harbor	AP	U.S.A.	UHSLC

Table 4.12 Storm surges exceeding 0.5 m observed at 10 stations for each named TC that formed in 2024

Station	Named TC	Storm surge [m]
SP	Yagi (2411)	0.55
QB	Krathon (2418)	0.59
SP	Krathon (2418)	0.54
QB	Trami (2420)	0.51
SP	Trami (2420)	0.52
QB	Man-yi (2424)	0.61
SP	Man-yi (2424)	0.65

4.7.1 Deterministic Prediction

Storm surges exceeding 1.0 m were not observed in any of 10 stations in 2024 (Table 4.12). Figure 4.18 shows scatter diagrams of modeled storm surges (hindcast and forecast) against observation data. Verification results for 2024 indicate that deterministic predictions are generally consistent with observation data, although prediction errors are somewhat large for T+97 – 120.

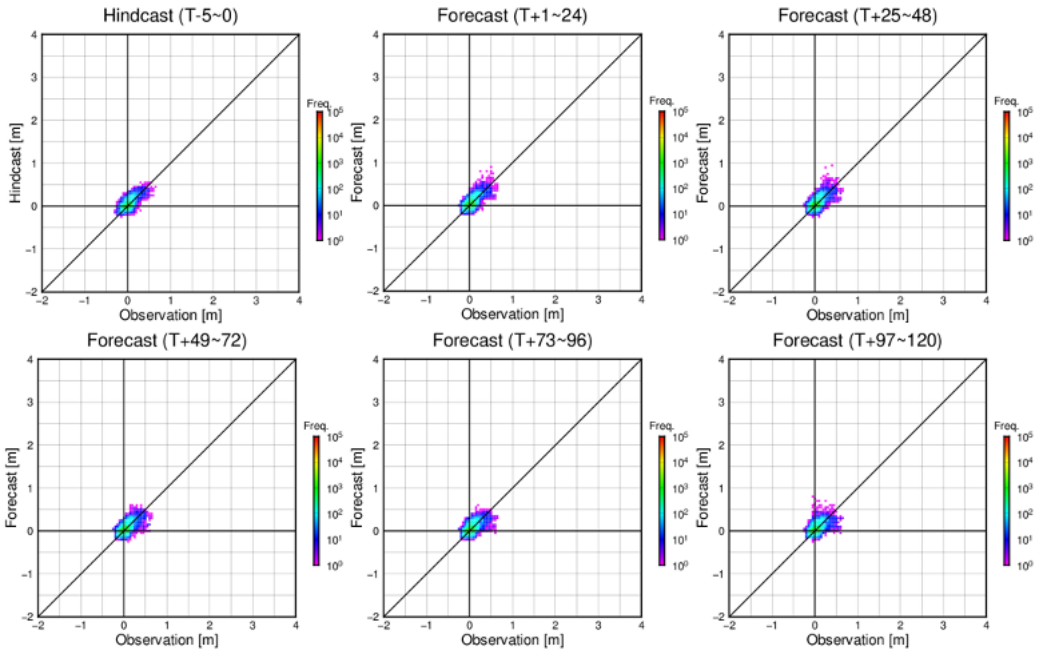


Figure 4.18 Scatter diagrams of modeled storm surges against observation data from 10 stations for all the named TCs that formed in 2024 (top left: hindcast; others: forecast).

The verification results shown in Figure 4.18 may be insufficient to evaluate model accuracy for TCs, given that there were sparse observation data for verification and/or that remarkable storm surges were not observed at most stations. Accordingly, additional verification was conducted using data from stations in Japan, where sufficient observation data are available and TCs frequently approach or make landfall. Although the characteristics of model forecasts may vary by region, the system is considered to have comparable accuracy at storm surge watch scheme stations.

Figure 4.19 shows scatter diagrams of modeled storm surges (forecast) against observation data from around 200 stations (operated by JMA, the Ports and Harbours Bureau, the Japan Coast Guard, and the Geospatial Information Authority of Japan) in Japan. The verification period is from January to December 2024, and cases of TCs are extracted. Eleven named TCs approached the country, including STS Maria (2405) and TY Shanshan (2410) making landfall. The diagrams indicate that forecasts for Japan compare well with observed storm surges, although some predictions exhibit significant errors (mainly due to large track prediction errors of TY Shanshan (2410)). Naturally, prediction errors increase with lead time.

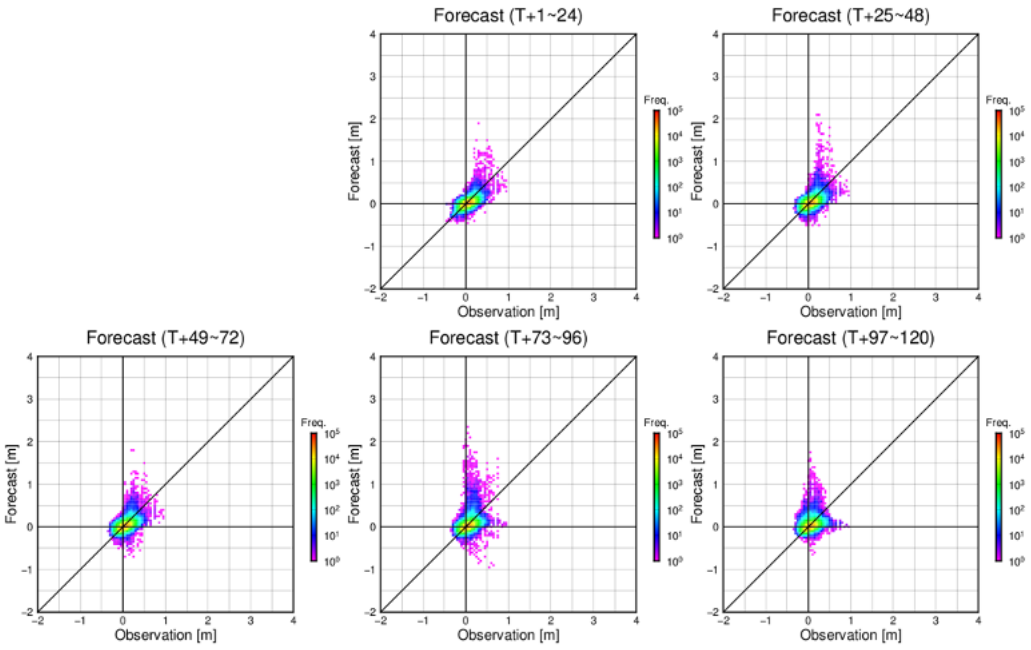


Figure 4.19 Scatter diagrams of modeled storm surges (forecast) against observation data from around 200 stations (operated by JMA, the Ports and Harbours Bureau, the Japan Coast Guard, and the Geospatial Information Authority of Japan) in Japan for TCs in 2024. All plots are three-hourly maximum values.

4.7.2 Ensemble Prediction

Figure 4.20 presents threat scores of ensemble prediction in Japan for TCs in 2024. The verification period and observation data used are as per those for deterministic forecast verification in 4.7.1. The results show low scores throughout the forecast period, even though the storm surge threshold was set to a relatively low 0.5 m. These reduced scores are attributed to significant prediction errors for specific typhoons (e.g., TY Shanshan (2410), 4.7.1) and a low number of remarkable storm surges.

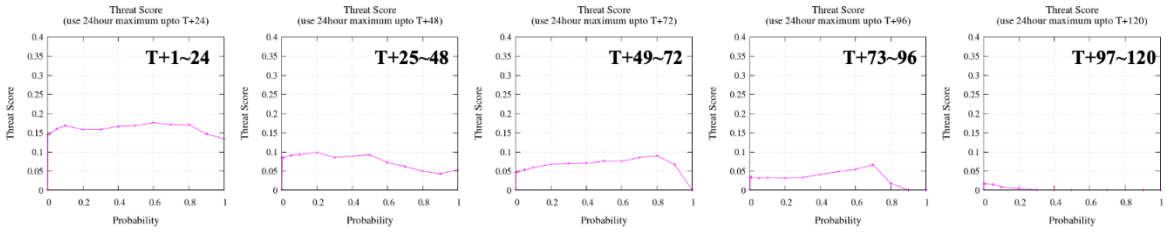


Figure 4.20 Threat scores of the ensemble prediction system for each probability against storm surges exceeding 0.5 m at around 200 stations in Japan in 2024.

4.7.3 Case Study

In September 2024, TY Yagi (2411) crossed Luzon Island in the Philippines and moved westward over the South China Sea, developing to a maximum sustained wind speed of 105 kt and a minimum pressure of 915 hPa. Figure 4.21 shows the best track and all predicted tracks (official forecast and 51 tracks calculated using GEPS) covering the 72-hour period before the storm surge peaked in Shek Pik. The official forecast competently predicted the track, and temporal variations in the storm surge with the typhoon approaching were also appropriately predicted for Shek Pik (Figure 4.22; observed maximum: 0.55 m; predicted maximum: 0.51 m).

In the ensemble system, tracks were moderately spread around the official forecast track (Figure 4.21), and were considered suitable for evaluation of potential storm surges. The system predicted the potential for storm surges exceeding 1.0 m around Hong Kong and Hainan Island (Figure 4.23). In Shek Pik, some members predicted significantly large storm surges (ensemble maximum 2.49 m; Figure 4.24), although no such conditions were actually observed. However, it is notable that the system was able to capture the risk of remarkable storm surges in the early stages of typhoon approach.

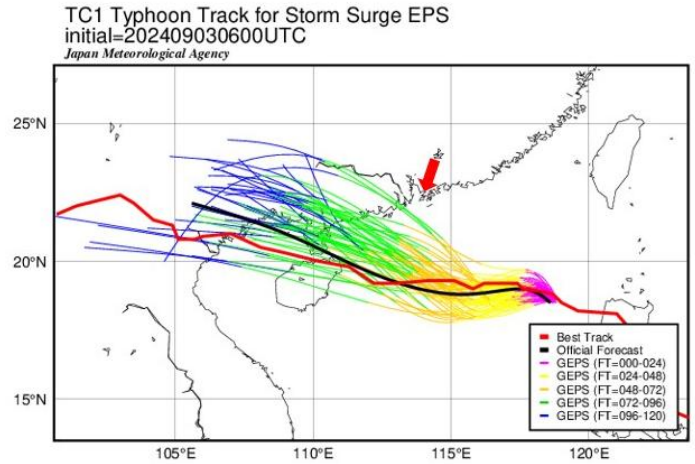


Figure 4.21 Best track and predicted tracks for TY Yagi (2411). In the figure, colored thin lines show the 51 tracks from GEPS members, and the bold red and black lines show the best track (6-hourly data) and the official forecast, respectively. The red arrow shows the location of Shek Pik.

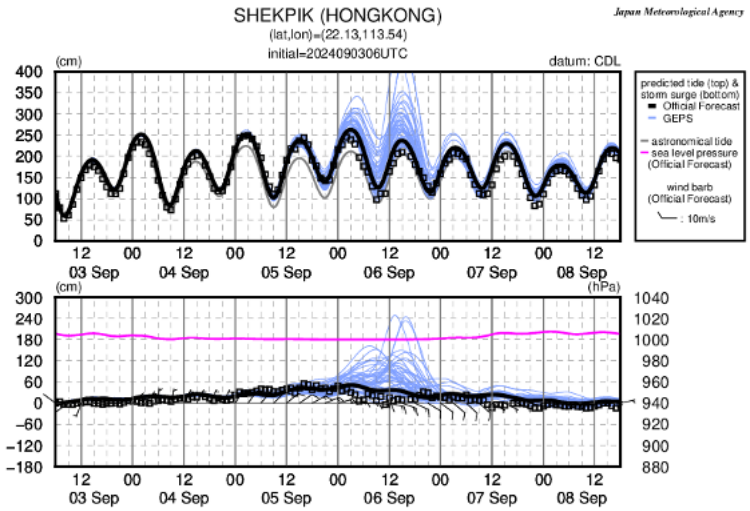


Figure 4.22 Time-series representation of storm tide and astronomical tide (top), storm surge, sea-level pressure and surface wind (bottom) for Shek Pik. Squares show hourly observation data.

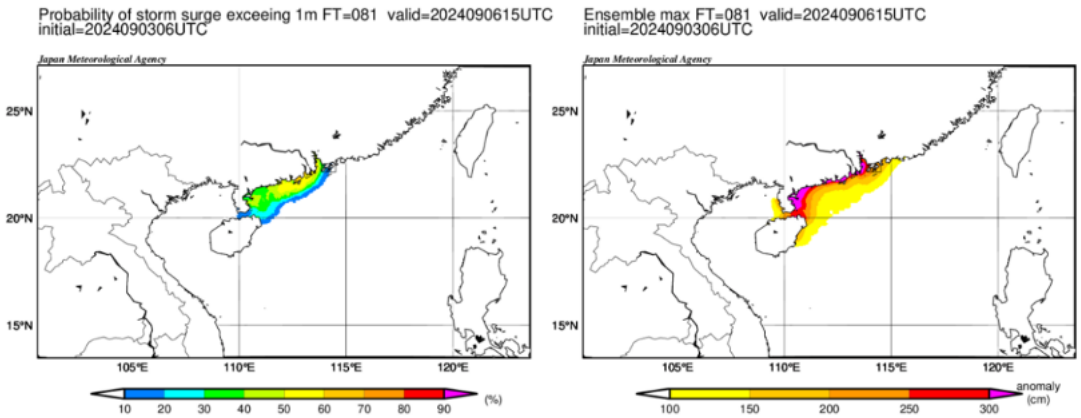


Figure 4.23 Probability of storm surges exceeding 1.0 m (left) and ensemble maxima (right).

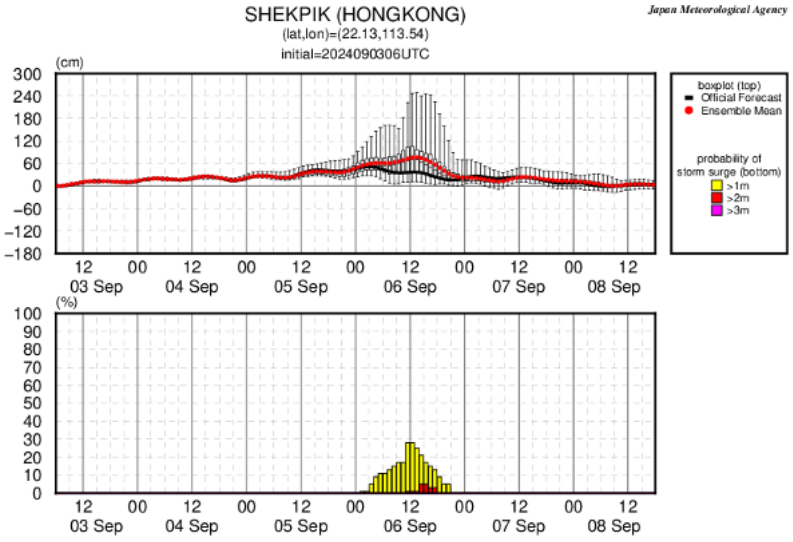


Figure 4.24 Time-series representation of storm surge boxplots (top), storm surge probability bars (bottom) for Shek Pik.

[Reference]

Hasegawa. H., N. Kohno, and H. Hayashibara, 2012: JMA's Storm Surge Prediction for the WMO Storm Surge Watch Scheme (SSWS). *RSMC Tokyo-Typhoon Center Technical Review*, **14**, 13-24.

Hasegawa. H., N. Kohno, M. Higaki, and M. Itoh, 2017: Upgrade of JMA's Storm Surge Prediction for WMO Storm Surge Watch Scheme (SSWS). *RSMC Tokyo-Typhoon Center Technical Review*, **19**, 26-34.

Hasegawa. H., J. Sugano, T. Fukuura and M. Higaki, 2023: Upgrade of JMA's Storm Surge Prediction for WMO Storm Surge Watch Scheme (SSWS) in 2022. *RSMC Tokyo-Typhoon Center Technical Review*, **25**, 1-14.

Appendices

Appendix 1
RSMC Tropical Cyclone Best Track Data in 2024

TY EWINIAR (2401)

Date/Time	(UTC)	Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	CI num.	Grade
May	23/18	8.3	129.6	1004	–	1.0	TD
	24/00	8.5	128.3	1006	–	1.0	TD
	24/06	9.4	127.5	1004	–	1.5	TD
	24/12	10.3	126.3	1006	–	2.0	TD
	24/18	11.3	125.3	1004	–	2.0	TD
	25/00	12.3	123.8	1006	–	2.0	TD
	25/06	12.8	123.2	1004	–	2.0	TD
	25/12	13.4	122.3	1002	35	2.5	TS
	25/18	13.7	121.8	998	45	3.0	TS
	26/00	14.1	121.4	994	50	3.0	STS
	26/06	14.3	121.7	990	55	3.5	STS
	26/12	14.9	122.2	980	65	4.0	TY
	26/18	15.5	122.5	975	70	4.5	TY
	27/00	15.8	122.8	970	75	5.0	TY
	27/06	16.4	123.5	970	70	5.0	TY
	27/12	17.2	123.9	970	70	5.0	TY
	27/18	17.8	124.5	970	70	5.0	TY
	28/00	18.5	125.5	975	65	4.5	TY
	28/06	19.8	126.6	975	65	4.5	TY
	28/12	21.1	128.2	975	65	4.5	TY
	28/18	23.0	129.3	975	65	4.5	TY
	29/00	24.3	130.9	980	60	4.0	STS
	29/03	24.9	131.6	980	60	–	STS
	29/06	25.6	132.2	980	60	4.0	STS
	29/12	26.4	133.1	985	55	4.0	STS
	29/18	27.5	134.0	990	50	3.5	STS
	30/00	28.0	134.7	992	45	3.0	TS
	30/06	28.9	135.9	996	40	2.5	TS
	30/12	29.8	136.9	996	40	2.0	TS
	30/18	31.4	137.7	998	–	1.5	L
	31/00	33.0	140.1	1000	–	–	L
	31/06	34.9	143.2	996	–	–	L
	31/12	36.5	146.8	994	–	–	L
	31/18	38.0	150.9	992	–	–	L
Jun.	01/00	39.1	155.1	992	–	–	L
	01/06	40.5	159.2	992	–	–	L
	01/12	41.5	162.9	992	–	–	L
	01/18	43.0	168.5	992	–	–	L
	02/00	44.6	174.3	992	–	–	L
	02/06	46.2	179.1	992	–	–	L
	02/12	47.9	184.9	988	–	–	Out

TS MALIKSI (2402)

Date/Time	(UTC)	Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	CI num.	Grade
May	30/00	18.0	111.9	1002	–	0.0	TD
	30/06	18.2	111.9	1000	–	0.5	TD
	30/12	18.3	111.9	1000	–	1.0	TD
	30/18	18.9	112.2	1000	–	1.5	TD
	31/00	19.8	112.6	998	35	1.5	TS
	31/06	20.3	111.9	998	35	1.5	TS
	31/12	21.2	111.3	1000	–	1.5	TD
	31/18	21.8	111.5	1000	–	2.0	TD
Jun.	01/00	22.4	111.8	1004	–	1.5	TD
	01/06	23.5	112.3	1004	–	1.5	TD
	01/12	24.0	113.4	1004	–	1.0	TD
	01/18	24.8	115.2	1006	–	0.5	TD
	02/00	24.9	116.4	1006	–	–	L
	02/06	24.8	120.0	1004	–	–	L
	02/12	23.8	123.3	1004	–	–	L
	02/18	23.8	124.2	1002	–	–	L
	03/00	23.9	126.4	1004	–	–	L
	03/06	24.0	128.2	1002	–	–	L
	03/12	24.1	129.8	1002	–	–	L
	03/18	24.5	131.6	1002	–	–	L
	04/00	24.8	133.7	1004	–	–	L
	04/06	24.8	135.1	1004	–	–	L
	04/12	24.9	136.4	1006	–	–	L
	04/18	24.9	137.3	1008	–	–	L
	05/00	24.8	138.0	1010	–	–	L
	05/06	24.8	139.0	1010	–	–	L
	05/12						Dissip.

TY GAEMI (2403)

Date/Time	(UTC)	Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	CI num.	Grade
Jul.	19/00	11.4	133.1	1004	–	0.0	TD
	19/06	12.6	132.3	1004	–	0.5	TD
	19/12	14.1	131.3	1006	–	1.0	TD
	19/18	14.9	129.6	1004	–	1.5	TD
	20/00	15.5	128.5	1002	35	2.0	TS
	20/06	16.2	127.5	1000	40	2.5	TS
	20/12	16.3	126.8	998	40	2.5	TS
	20/18	16.3	126.2	998	40	2.5	TS
	21/00	16.4	125.7	994	45	3.0	TS
	21/06	16.4	125.6	992	50	3.0	STS
	21/12	16.5	125.5	992	50	3.0	STS
	21/18	16.8	125.5	985	60	3.5	STS
	22/00	17.2	125.5	980	65	4.0	TY
	22/06	17.7	125.5	980	65	4.0	TY
	22/12	18.2	125.4	980	65	4.0	TY
	22/18	18.7	125.2	975	70	4.5	TY
	23/00	19.5	125.1	970	75	5.0	TY
	23/06	20.7	125.0	970	75	5.0	TY
	23/12	22.0	124.5	965	75	5.0	TY
	23/15	22.6	123.9	955	80	–	TY
	23/18	22.8	123.5	950	85	5.5	TY
	23/21	23.1	123.4	945	85	–	TY
	24/00	23.6	123.2	945	85	5.5	TY
	24/03	23.9	122.9	935	90	–	TY
	24/06	24.2	122.5	935	90	6.0	TY
	24/09	24.1	121.9	950	75	–	TY
	24/12	23.5	121.6	960	65	6.0	TY
	24/15	24.1	121.8	970	60	–	STS
	24/18	24.8	121.4	970	60	5.5	STS
	25/00	25.1	120.3	970	60	5.0	STS
	25/06	25.2	119.7	975	55	5.0	STS
	25/12	25.4	119.2	980	50	4.5	STS
	25/18	25.7	118.9	980	45	4.0	TS
	26/00	26.4	118.3	985	40	3.5	TS
	26/06	27.5	117.7	988	35	3.0	TS
	26/12	27.9	116.8	990	35	3.0	TS
	26/18	27.9	115.9	992	–	2.5	TD
	27/00	28.4	115.2	996	–	2.5	TD
	27/06	28.6	114.7	996	–	–	TD
	27/12	29.1	114.0	998	–	–	TD
	27/18	29.6	113.6	998	–	–	TD
	28/00	29.9	112.6	1000	–	–	TD
	28/06	29.5	110.9	998	–	–	TD
	28/12	29.8	109.5	998	–	–	TD
	28/18	30.2	108.7	998	–	–	TD
	29/00						Dissip.

STS PRAPIROON (2404)

Date/Time	(UTC)	Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	CI num.	Grade
Jul.	20/00	14.6	115.6	1002	–	0.0	TD
	20/06	15.3	115.1	1002	–	0.5	TD
	20/12	15.7	113.6	1002	–	1.0	TD
	20/18	16.1	112.1	1000	–	1.5	TD
	21/00	16.0	111.3	998	35	2.0	TS
	21/06	16.6	111.1	998	35	2.0	TS
	21/12	17.5	110.6	996	40	2.0	TS
	21/18	18.6	110.2	992	45	2.5	TS
	22/00	19.5	109.2	990	50	3.0	STS
	22/06	20.1	108.5	985	55	3.5	STS
	22/12	20.5	108.1	985	55	3.5	STS
	22/18	21.1	107.8	985	55	3.5	STS
	23/00	21.5	107.5	990	45	3.0	TS
	23/06	21.6	107.6	992	35	2.5	TS
	23/12	21.5	106.7	994	–	2.0	TD
	23/18	21.5	106.4	994	–	–	TD
	24/00	21.6	106.5	994	–	–	TD
	24/06	21.7	106.6	994	–	–	TD
	24/12	21.7	106.6	994	–	–	TD
	24/18	20.8	107.4	994	–	–	TD
	25/00						Dissip.

STS MARIA (2405)

Date/Time	(UTC)	Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	CI num.	Grade
Aug.	05/06	24.0	140.8	1004	–	0.0	TD
	05/12	24.1	140.3	1004	–	0.0	TD
	05/18	24.4	140.1	1002	–	0.5	TD
	06/00	25.0	140.2	1004	–	0.5	TD
	06/06	25.5	140.3	1002	–	0.5	TD
	06/12	26.0	140.8	1000	–	1.0	TD
	06/18	26.1	141.1	998	–	1.5	TD
	07/00	26.1	141.2	998	–	1.5	TD
	07/06	25.8	141.4	998	–	1.5	TD
	07/12	25.6	142.2	998	–	2.0	TD
	07/18	25.7	142.7	996	35	2.0	TS
	08/00	26.6	144.0	994	40	2.5	TS
	08/06	27.6	144.7	990	45	2.5	TS
	08/12	28.7	145.3	985	50	3.0	STS
	08/18	29.8	145.6	980	55	3.5	STS
	09/00	30.8	146.0	980	55	3.5	STS
	09/06	32.4	146.0	980	55	3.5	STS
	09/12	33.3	145.9	980	55	3.5	STS
	09/18	34.2	146.0	980	55	3.5	STS
	10/00	35.0	146.0	985	45	3.5	TS
	10/06	36.0	145.5	985	45	3.5	TS
	10/12	36.5	145.2	980	50	3.5	STS
	10/18	36.9	145.0	980	50	3.0	STS
	11/00	37.6	144.4	980	50	3.0	STS
	11/06	37.7	143.9	980	50	3.0	STS
	11/09	37.8	143.6	980	50	–	STS
	11/12	37.9	143.4	980	50	3.0	STS
	11/15	38.0	143.0	980	50	–	STS
	11/18	38.3	142.6	980	50	3.0	STS
	11/21	38.7	142.1	985	50	–	STS
	11/23	38.9	141.8	985	50	–	STS
	12/00	39.0	141.7	992	45	3.0	TS
	12/03	39.3	141.2	994	40	–	TS
	12/06	39.9	140.5	998	–	3.0	TD
	12/12	40.4	139.8	1002	–	2.5	TD
	12/18	41.1	139.4	1002	–	2.0	TD
	13/00	41.4	139.0	1004	–	2.0	TD
	13/06	42.3	139.0	1004	–	2.0	TD
	13/12	42.2	139.0	1006	–	2.0	TD
	13/18	42.2	139.0	1006	–	2.0	TD
	14/00	41.4	139.4	1006	–	1.5	TD
	14/06	41.2	140.2	1006	–	1.5	TD
	14/12	41.6	141.5	1006	–	1.5	TD
	14/18						Dissip.

TS SON-TINH (2406)

Date/Time	(UTC)	Center Position Lat (N)	Lon (E)	Central pressure (hPa)	Max Wind (kt)	CI num.	Grade
Aug.	10/12	26.5	154.1	1000	–	0.5	TD
	10/18	26.8	155.0	998	–	1.0	TD
	11/00	27.4	155.1	996	35	1.0	TS
	11/06	27.8	155.0	996	35	1.5	TS
	11/12	28.8	154.5	994	40	2.0	TS
	11/18	30.2	154.4	996	35	2.0	TS
	12/00	31.5	152.5	998	35	2.0	TS
	12/06	32.3	151.5	998	35	2.0	TS
	12/12	32.9	150.5	998	35	2.0	TS
	12/18	34.2	149.2	998	35	2.0	TS
	13/00	35.2	147.8	1000	35	1.5	TS
	13/06	36.1	146.7	1000	35	1.5	TS
	13/12	37.0	146.0	1004	–	1.5	TD
	13/18	38.7	145.6	1006	–	1.5	TD
	14/00	39.8	145.7	1006	–	1.0	TD
	14/06	41.7	146.5	1006	–	1.0	TD
	14/12	43.4	148.0	1004	–	1.0	TD
	14/18	44.6	150.4	1004	–	–	TD
	15/00	47.3	154.7	1002	–	–	L
	15/06	47.5	157.7	1000	–	–	L
	15/12	47.6	161.0	996	–	–	L
	15/18	47.0	164.4	992	–	–	L
	16/00	45.7	168.4	990	–	–	L
	16/06	45.8	173.1	988	–	–	L
	16/12	47.8	176.3	986	–	–	L
	16/18	50.9	179.0	984	–	–	L
	17/00	53.6	180.9	978	–	–	Out

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
TY AMPIL (2407)							
Aug.	11/12	21.7	134.9	1002	–	0.0	TD
	11/18	22.0	135.4	1000	–	0.5	TD
	12/00	22.4	135.8	1000	–	1.0	TD
	12/06	22.7	136.1	998	–	1.5	TD
	12/12	23.1	136.6	996	35	1.5	TS
	12/18	23.6	137.1	996	35	2.0	TS
	13/00	24.2	137.9	994	40	2.5	TS
	13/06	24.7	138.7	990	45	3.0	TS
	13/12	25.3	139.0	985	55	3.5	STS
	13/18	25.5	139.4	975	60	4.0	STS
	14/00	26.1	140.3	975	60	4.0	STS
	14/06	26.8	140.9	975	60	4.0	STS
	14/12	27.5	141.3	975	60	4.0	STS
	14/18	28.5	141.3	975	60	4.0	STS
	15/00	29.5	141.2	970	65	4.0	TY
	15/06	30.6	141.1	965	70	4.5	TY
	15/09	31.1	141.0	955	80	–	TY
	15/12	31.6	140.8	950	85	5.5	TY
	15/15	32.0	140.8	950	85	–	TY
	15/18	32.6	140.8	950	85	5.5	TY
	15/21	33.2	140.9	950	85	–	TY
	16/00	33.5	140.7	950	85	5.5	TY
	16/03	33.8	140.8	950	85	–	TY
	16/06	34.1	141.1	950	85	5.5	TY
	16/09	34.5	141.7	950	85	–	TY
	16/12	35.0	142.0	950	85	5.5	TY
	16/15	35.5	142.3	950	85	–	TY
	16/18	35.9	142.9	950	85	5.5	TY
	17/00	36.6	143.8	950	85	5.5	TY
	17/06	37.3	145.6	955	70	5.0	TY
	17/12	37.3	148.2	960	65	4.5	TY
	17/18	38.3	150.1	965	60	4.0	STS
	18/00	39.5	152.8	970	55	3.5	STS
	18/06	40.5	155.3	970	55	3.0	STS
	18/12	41.8	158.0	975	50	3.0	STS
	18/18	43.1	160.7	975	50	2.5	STS
	19/00	44.2	162.5	976	–	2.5	L
	19/06	46.1	164.8	976	–	–	L
	19/12	47.9	167.8	976	–	–	L
	19/18	50.7	170.4	972	–	–	L
	20/00	53.9	170.6	964	–	–	L
	20/06	55.5	170.5	960	–	–	L
	20/12	56.9	171.4	962	–	–	L
	20/18	57.8	172.3	968	–	–	L
	21/00	59.1	174.8	968	–	–	L
	21/06	60.4	178.1	972	–	–	Out

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
TS WUKONG (2408)							
Aug.	11/18	23.9	146.7	1002	–	0.0	TD
	12/00	24.5	147.9	1004	–	0.5	TD
	12/06	25.4	148.6	1004	–	1.0	TD
	12/12	25.9	149.4	1006	–	1.0	TD
	12/18	26.2	149.8	1004	–	1.0	TD
	13/00	26.4	150.1	1002	35	1.5	TS
	13/06	26.5	150.4	1002	35	2.0	TS
	13/12	27.2	150.5	1004	35	2.0	TS
	13/18	28.3	149.8	1002	35	2.0	TS
	14/00	29.2	149.2	1002	35	2.0	TS
	14/06	30.6	147.9	1002	35	2.0	TS
	14/12	31.8	147.2	1006	–	2.0	TD
	14/18	34.2	146.6	1006	–	1.5	TD
	15/00	35.8	146.3	1008	–	1.5	TD
	15/06	37.2	147.2	1008	–	1.5	TD
	15/12	38.9	148.2	1008	–	–	TD
	15/18	40.2	150.5	1008	–	–	TD
	16/00	39.9	152.7	1008	–	–	TD
	16/06	39.5	156.5	1008	–	–	TD
	16/12	39.4	160.5	1006	–	–	L
	16/18	39.3	163.7	1006	–	–	L
	17/00	39.2	166.9	1004	–	–	L
	17/06	39.1	169.7	1004	–	–	L
	17/12	38.9	172.5	1004	–	–	L
	17/18	39.0	175.0	1004	–	–	L
	18/00	39.3	176.4	1004	–	–	L
	18/06	39.1	177.7	1006	–	–	L
	18/12	39.0	178.9	1008	–	–	L
	18/18	39.4	179.6	1008	–	–	L
	19/00	39.5	179.8	1010	–	–	L
	19/06	39.7	180.1	1010	–	–	Out

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
TS JONGDARI (2409)							
Aug.	18/00	23.5	126.8	1004	–	0.0	TD
	18/06	23.8	126.5	1000	–	0.5	TD
	18/12	24.1	126.4	998	35	1.0	TS
	18/18	24.6	126.2	998	35	1.5	TS
	19/00	25.2	126.2	998	35	2.0	TS
	19/06	26.3	126.0	996	40	2.0	TS
	19/12	27.6	125.9	996	40	2.0	TS
	19/18	29.4	125.6	996	40	2.0	TS
	20/00	31.0	125.8	998	40	2.0	TS
	20/06	32.6	125.4	998	35	2.0	TS
	20/12	34.0	126.0	1002	35	2.0	TS
	20/18	36.6	125.4	1004	35	–	TS
	21/00	37.7	126.1	1006	–	–	TD
	21/06	39.0	127.9	1006	–	–	TD
	21/12	40.2	130.3	1006	–	–	TD
	21/18	42.3	132.1	1004	–	–	TD
	22/00	42.1	133.7	1002	–	–	L
	22/06	43.6	136.0	1000	–	–	L
	22/12	44.7	138.3	1000	–	–	L
	22/18						Dissip.

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
TY SHANSHAN (2410)							
Aug.	20/06	14.8	147.7	1008	–	0.0	TD
	20/12	15.2	146.3	1010	–	0.0	TD
	20/18	15.6	145.1	1008	–	0.0	TD
	21/00	16.0	144.0	1008	–	0.5	TD
	21/06	16.5	143.4	1008	–	1.0	TD
	21/12	16.6	142.9	1006	–	1.5	TD
	21/18	16.6	142.2	1002	35	2.0	TS
	22/00	16.7	141.7	1000	40	2.5	TS
	22/06	16.6	141.6	998	45	3.0	TS
	22/12	16.6	141.6	990	55	3.5	STS
	22/18	16.6	141.4	985	60	3.5	STS
	23/00	17.4	141.5	985	60	3.5	STS
	23/06	17.8	141.4	985	60	3.5	STS
	23/12	18.1	141.4	985	60	3.5	STS
	23/18	18.7	141.3	985	60	3.5	STS
	24/00	20.0	141.3	980	65	3.5	TY
	24/06	21.7	141.0	980	65	4.0	TY
	24/12	22.3	140.8	980	65	4.0	TY
	24/18	23.6	140.2	980	65	4.0	TY
	25/00	24.6	139.0	980	65	4.0	TY
	25/06	25.7	137.6	980	65	4.0	TY
	25/12	26.3	136.3	980	65	4.0	TY
	25/18	26.8	135.0	980	65	4.0	TY
	26/00	27.2	133.8	980	65	4.0	TY
	26/06	27.5	132.8	980	65	4.0	TY
	26/12	27.7	132.0	980	65	4.0	TY
	26/15	27.8	131.6	975	70	–	TY
	26/18	28.0	131.2	970	75	5.0	TY
	26/21	28.1	131.0	960	80	–	TY
	27/00	28.2	130.8	950	85	5.5	TY
	27/03	28.3	130.6	950	85	–	TY
	27/06	28.5	130.4	950	85	5.5	TY
	27/09	28.6	130.3	950	85	–	TY
	27/12	28.6	130.3	940	90	6.0	TY
	27/15	28.8	130.3	935	95	–	TY
	27/18	29.0	130.1	935	95	6.0	TY
	27/21	29.0	130.0	935	95	–	TY
	28/00	29.2	130.1	935	95	6.0	TY
	28/03	29.6	130.1	935	95	–	TY
	28/06	30.0	130.1	935	95	6.0	TY
	28/09	30.2	130.1	935	95	–	TY
	28/12	30.6	130.2	935	90	5.5	TY
	28/15	30.8	130.0	940	85	–	TY
	28/18	31.3	130.0	945	85	5.0	TY
	28/21	31.7	130.1	955	75	–	TY
	28/23	31.9	130.3	955	75	–	TY
	29/00	32.2	130.3	960	75	4.5	TY
	29/03	32.5	130.2	970	65	–	TY
	29/06	32.7	130.2	980	55	4.0	STS
	29/09	32.8	130.4	985	50	–	STS
	29/12	32.8	130.5	990	45	3.5	TS
	29/15	32.9	130.6	992	40	–	TS
	29/18	33.1	130.8	992	40	3.0	TS
	29/21	33.2	131.3	992	40	–	TS
	30/00	33.5	131.6	994	35	2.5	TS
	30/03	33.7	131.9	994	35	–	TS
	30/06	33.8	132.4	994	35	2.5	TS
	30/12	34.0	133.6	996	–	2.5	TD
	30/18	33.6	134.1	996	–	2.5	TD
	31/00	33.3	135.1	996	–	2.5	TD
	31/06	33.1	135.9	996	–	2.0	TD
	31/12	32.9	137.1	996	–	2.0	TD
	31/18	33.1	137.1	998	–	2.0	TD
Sep.	01/00	33.2	137.0	1002	–	1.5	TD
	01/06	33.9	136.9	1002	–	1.5	TD
	01/12	35.1	136.3	1006	–	–	TD
	01/18						Dissip.

TY YAGI (2411)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Aug.	31/12	12.1	128.9	1004	–	1.5	TD
	31/18	12.1	127.6	1004	–	2.0	TD
Sep.	01/00	12.1	126.4	1002	–	2.0	TD
	01/06	13.1	125.1	1000	35	2.0	TS
	01/12	14.0	124.4	1000	35	2.0	TS
	01/18	14.5	123.2	996	40	2.5	TS
	02/00	15.3	122.9	994	45	2.5	TS
	02/06	16.2	122.2	994	45	2.5	TS
	02/12	17.3	121.7	996	40	2.5	TS
	02/18	18.1	121.0	1000	35	2.0	TS
	03/00	18.2	119.6	996	40	2.5	TS
	03/06	18.5	119.0	992	45	2.5	TS
	03/12	18.8	118.7	990	50	3.0	STS
	03/18	18.9	118.3	980	60	3.5	STS
	04/00	19.0	117.6	970	70	4.0	TY
	04/06	19.2	117.4	955	80	5.0	TY
	04/12	19.2	117.0	940	90	5.5	TY
	04/18	19.2	116.2	925	100	6.0	TY
	05/00	19.0	115.8	915	105	6.5	TY
	05/06	19.3	115.1	915	105	6.5	TY
	05/12	19.3	114.2	915	105	6.5	TY
	05/18	19.2	113.0	915	105	6.5	TY
	06/00	19.2	112.2	915	105	6.5	TY
	06/06	19.8	111.3	915	105	6.5	TY
	06/12	20.0	110.2	930	95	5.5	TY
	06/18	20.3	109.0	945	85	5.0	TY
	07/00	20.5	108.1	940	85	5.0	TY
	07/06	21.0	107.0	935	90	5.5	TY
	07/12	20.9	106.0	980	55	4.5	STS
	07/18	20.8	105.7	992	40	4.5	TS
	08/00	20.8	105.1	996	35	4.0	TS
	08/06	21.3	104.9	996	35	3.5	TS
	08/12	21.5	104.2	998	–	3.0	TD
	08/18	22.1	103.5	1000	–	3.0	TD
	09/00	22.4	103.0	1000	–	2.5	TD
	09/06	22.0	101.4	1000	–	2.0	TD
	09/12	21.7	100.7	1000	–	2.0	TD
	09/18						Dissip.

TS LEEPI (2412)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Sep.	01/12	22.2	147.1	1012	–	0.0	TD
	01/18	22.6	146.8	1010	–	0.5	TD
	02/00	22.9	146.6	1012	–	0.5	TD
	02/06	23.6	146.5	1010	–	0.5	TD
	02/12	24.0	146.8	1012	–	0.5	TD
	02/18	24.6	147.3	1010	–	0.5	TD
	03/00	24.8	147.3	1010	–	0.5	TD
	03/06	25.0	147.1	1008	–	0.0	TD
	03/12	25.7	147.6	1008	–	0.5	TD
	03/18	26.6	147.1	1006	–	1.0	TD
	04/00	27.8	147.0	1006	–	1.5	TD
	04/06	29.2	146.9	1004	–	1.5	TD
	04/12	30.2	147.2	1006	–	1.5	TD
	04/18	31.3	146.2	1004	–	1.5	TD
	05/00	32.2	145.9	1002	35	2.0	TS
	05/06	33.2	145.8	1002	35	2.0	TS
	05/12	33.9	145.9	1004	35	2.5	TS
	05/18	34.9	146.9	1004	35	2.5	TS
	06/00	35.8	148.2	1004	35	2.5	TS
	06/06	36.9	149.7	1004	35	2.5	TS
	06/12	37.8	151.1	1006	–	2.5	TD
	06/18	39.0	153.1	1008	–	2.0	TD
	07/00	40.6	155.6	1008	–	1.5	L
	07/06	42.3	157.3	1008	–	–	L
	07/12	44.1	160.6	1006	–	–	L
	07/18	46.5	165.0	1006	–	–	L
	08/00	47.7	169.0	1004	–	–	L
	08/06	50.4	173.8	1004	–	–	L
	08/12	52.5	179.7	1004	–	–	L
	08/18	54.0	187.0	1004	–	–	Out

TY BEBINCA (2413)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Sep.	09/18	10.1	147.8	1002	–	0.5	TD
	10/00	11.1	147.0	1002	–	1.0	TD
	10/06	11.9	146.3	1000	–	1.5	TD
	10/12	12.8	145.4	998	35	2.0	TS
	10/18	13.5	144.2	998	35	2.5	TS
	11/00	13.9	143.2	996	40	2.5	TS
	11/06	14.5	142.3	996	40	2.5	TS
	11/12	15.1	141.6	996	40	2.5	TS
	11/18	16.4	140.8	996	40	2.5	TS
	12/00	18.0	140.0	992	45	3.0	TS
	12/06	19.2	139.6	992	45	3.0	TS
	12/12	20.4	138.6	992	45	3.0	TS
	12/18	21.1	137.6	992	40	3.0	TS
	13/00	22.1	136.9	994	40	3.0	TS
	13/06	23.4	135.6	990	45	3.0	TS
	13/12	24.7	133.7	990	45	3.0	TS
	13/18	25.3	132.6	985	50	3.0	STS
	14/00	26.4	131.6	985	50	3.0	STS
	14/03	26.9	130.8	980	55	–	STS
	14/06	27.4	130.2	980	55	3.0	STS
	14/09	27.8	129.5	980	55	–	STS
	14/12	28.1	129.2	975	60	4.0	STS
	14/15	28.5	128.6	975	60	–	STS
	14/18	28.9	128.0	970	65	4.5	TY
	15/00	29.6	127.2	965	75	5.0	TY
	15/06	30.1	126.1	965	75	5.0	TY
	15/12	30.4	124.8	965	75	5.0	TY
	15/18	30.6	123.3	970	70	4.5	TY
	16/00	31.0	121.8	980	65	4.0	TY
	16/06	31.4	120.5	985	60	4.0	STS
	16/12	31.7	119.3	992	50	3.5	STS
	16/18	31.9	118.0	1000	35	3.0	TS
	17/00	32.4	117.2	1004	–	2.5	TD
	17/06	32.9	116.4	1004	–	2.0	TD
	17/12	33.1	116.1	1006	–	–	TD
	17/18	33.3	115.6	1008	–	–	TD
	18/00	33.5	115.3	1008	–	–	TD
	18/06	33.8	115.1	1008	–	–	TD
	18/12						Dissip.

TS PULASAN (2414)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Sep.	15/00	12.1	144.6	1002	–	–	TD
	15/06	12.3	144.3	1000	–	–	TD
	15/12	12.8	144.3	1000	35	0.0	TS
	15/18	13.9	144.2	998	35	0.5	TS
	16/00	15.8	143.7	998	35	1.0	TS
	16/06	16.1	142.0	998	35	1.5	TS
	16/12	16.4	140.8	996	40	1.5	TS
	16/18	17.7	140.1	996	40	1.5	TS
	17/00	20.0	140.1	992	45	2.0	TS
	17/06	21.2	137.4	992	45	2.0	TS
	17/12	21.7	134.5	992	45	2.0	TS
	17/18	22.6	133.7	992	45	2.0	TS
	18/00	23.4	131.9	992	45	2.0	TS
	18/06	24.5	130.6	992	45	2.0	TS
	18/12	26.1	128.8	996	40	2.0	TS
	18/18	27.3	127.2	998	40	2.0	TS
	19/00	28.3	125.6	998	40	2.0	TS
	19/06	30.1	123.5	998	40	2.0	TS
	19/12	30.7	122.0	1000	35	2.0	TS
	19/18	31.3	120.9	1000	35	2.0	TS
	20/00	31.8	120.4	1000	35	1.5	TS
	20/06	32.0	120.4	1000	35	2.0	TS
	20/12	32.7	121.2	1000	35	2.0	TS
	20/18	33.2	122.3	998	40	2.0	TS
	21/00	33.6	123.7	998	40	2.0	TS
	21/06	33.9	125.3	1000	–	2.0	L
	21/12	34.2	127.7	1002	–	2.0	L
	21/18	36.0	132.6	1000	–	–	L
	22/00	37.4	138.0	1000	–	–	L
	22/06	38.8	143.1	1000	–	–	L
	22/12	39.0	146.5	1000	–	–	L
	22/18	39.7	149.7	1000	–	–	L
	23/00	40.0	152.4	1002	–	–	L
	23/06	41.2	156.5	1002	–	–	L
	23/12	42.6	160.9	1004	–	–	L
	23/18	43.6	165.1	1004	–	–	L
	24/00	44.5	169.5	1004	–	–	L
	24/06	45.0	172.8	1004	–	–	L
	24/12	46.1	177.4	1004	–	–	L
	24/18	46.1	182.7	1002	–	–	Out

TS SOULIK (2415)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Sep.	15/00	16.7	126.0	998	–	0.0	TD
	15/06	16.8	126.5	996	–	0.0	TD
	15/12	16.9	126.0	998	–	0.5	TD
	15/18	17.3	125.6	996	–	1.0	TD
	16/00	17.2	125.1	998	–	1.5	TD
	16/06	17.4	124.7	996	–	1.5	TD
	16/12	17.5	123.3	996	–	2.0	TD
	16/18	17.7	121.9	996	–	1.5	TD
	17/00	17.7	119.8	998	–	1.5	TD
	17/06	17.2	119.6	996	–	1.5	TD
	17/12	17.3	118.6	996	–	1.5	TD
	17/18	17.4	117.7	996	–	1.5	TD
	18/00	17.5	115.5	996	–	1.5	TD
	18/06	17.3	113.4	996	–	1.5	TD
	18/12	17.3	111.3	996	–	1.5	TD
	18/18	17.5	110.0	992	35	1.5	TS
	19/00	17.5	108.3	992	35	2.0	TS
	19/06	17.0	107.3	992	35	2.0	TS
	19/12	16.9	106.9	996	–	2.0	TD
	19/18	16.9	106.5	998	–	2.0	TD
	20/00	16.7	105.6	998	–	1.5	TD
	20/06	17.1	104.6	1000	–	1.5	TD
	20/12	17.1	103.9	1002	–	–	TD
	20/18						Dissip.

TS CIMARON (2416)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Sep.	23/06	29.1	129.3	1008	–	0.5	TD
	23/12	28.7	131.3	1006	–	1.0	TD
	23/18	28.3	132.8	1004	–	1.5	TD
	24/00	27.9	133.6	1002	–	1.5	TD
	24/06	27.8	134.2	1000	35	1.5	TS
	24/12	27.9	135.1	998	35	2.0	TS
	24/18	28.0	135.4	998	35	1.5	TS
	25/00	28.4	134.9	998	35	1.5	TS
	25/06	28.2	133.9	998	35	1.5	TS
	25/12	27.8	133.3	998	35	1.5	TS
	25/18	28.0	132.9	998	35	1.5	TS
	26/00	28.2	132.4	998	35	2.0	TS
	26/06	28.0	132.0	1002	–	2.0	TD
	26/12	28.1	131.9	1004	–	2.0	TD
	26/18	28.5	132.2	1004	–	2.0	TD
	27/00	28.6	132.2	1004	–	2.0	TD
	27/06	28.8	132.7	1004	–	1.5	TD
	27/12	29.5	133.4	1006	–	–	TD
	27/18	31.0	133.5	1008	–	–	L
	28/00	32.1	136.0	1010	–	–	L
	28/06	32.7	137.2	1010	–	–	L
	28/12	32.6	139.6	1012	–	–	L
	28/18	32.6	140.7	1014	–	–	L
	29/00	32.7	141.6	1016	–	–	L
	29/06	32.7	141.5	1012	–	–	L
	29/12	32.7	140.7	1014	–	–	L
	29/18	32.6	140.4	1014	–	–	L
	30/00	32.6	139.7	1012	–	–	L
	30/06	32.3	138.5	1010	–	–	L
	30/12						Dissip.

TY JEBI (2417)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Sep.	25/18	14.8	148.9	1006	–	0.0	TD
	26/00	15.4	148.0	1006	–	0.5	TD
	26/06	16.0	147.5	1004	–	1.0	TD
	26/12	16.4	147.0	1004	–	1.5	TD
	26/18	16.8	146.6	1004	–	1.5	TD
	27/00	17.2	146.1	1002	35	2.0	TS
	27/06	17.7	145.8	1002	35	2.0	TS
	27/12	18.7	145.3	1002	35	2.0	TS
	27/18	19.4	144.6	1002	35	2.0	TS
	28/00	20.1	143.3	1002	35	2.0	TS
	28/06	20.7	142.8	1002	35	2.0	TS
	28/12	21.7	142.8	1002	35	2.0	TS
	28/18	22.2	142.0	1002	35	2.0	TS
	29/00	23.0	141.9	1002	35	2.0	TS
	29/06	23.8	141.2	1002	35	2.0	TS
	29/12	24.4	140.8	1002	35	2.0	TS
	29/18	24.9	140.7	1002	35	2.0	TS
	30/00	26.2	140.6	1000	40	2.5	TS
	30/06	27.9	140.8	994	45	2.5	TS
	30/12	29.3	140.9	992	50	3.0	STS
	30/18	30.8	141.1	990	55	3.5	STS
Oct.	01/00	32.6	141.7	980	65	4.5	TY
	01/06	34.8	142.3	980	65	4.5	TY
	01/12	37.2	143.4	980	65	4.5	TY
	01/18	39.2	145.6	980	65	4.5	TY
	02/00	41.9	148.8	985	60	4.0	STS
	02/06	45.1	153.3	990	50	3.5	STS
	02/12	49.0	157.0	992	–	3.0	L
	02/18	51.7	162.2	994	–	–	L
	03/00						Dissip.

TY KRATHON (2418)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Sep.	26/12	21.7	127.5	1006	–	0.0	TD
	26/18	21.3	127.0	1004	–	0.5	TD
	27/00	20.7	126.6	1004	–	1.0	TD
	27/06	20.0	126.3	1002	–	1.5	TD
	27/12	19.4	126.0	1002	–	1.5	TD
	27/18	18.9	125.6	1000	–	2.0	TD
	28/00	18.5	125.3	998	35	2.0	TS
	28/06	18.3	125.1	996	40	2.5	TS
	28/12	18.3	124.8	990	50	3.0	STS
	28/18	18.4	124.5	985	55	3.5	STS
	29/00	18.7	124.3	980	60	3.5	STS
	29/06	19.3	123.8	970	70	4.5	TY
	29/12	19.8	122.8	965	75	5.0	TY
	29/18	19.9	122.4	950	85	5.5	TY
	30/00	20.1	122.0	935	95	6.0	TY
	30/06	20.5	121.2	935	95	6.0	TY
	30/12	20.5	120.4	935	95	6.0	TY
	30/18	20.6	120.0	935	100	7.0	TY
Oct.	01/00	20.6	119.6	920	105	7.0	TY
	01/06	20.9	119.5	920	105	7.0	TY
	01/12	21.2	119.3	925	100	6.5	TY
	01/18	21.4	119.2	935	95	6.5	TY
	02/00	21.6	119.3	940	90	6.0	TY
	02/06	21.9	119.4	950	85	5.0	TY
	02/12	22.0	119.5	955	80	5.0	TY
	02/18	22.2	119.7	975	65	5.0	TY
	03/00	22.4	120.0	985	55	4.5	STS
	03/06	22.6	120.4	985	50	4.5	STS
	03/12	22.8	120.6	1004	–	4.0	TD
	03/18						Dissip.

TS BARIJAT (2419)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Oct.	04/18	11.6	148.2	1006	–	1.0	TD
	05/00	12.2	147.6	1006	–	1.5	TD
	05/06	13.2	147.1	1004	–	1.5	TD
	05/12	14.6	146.7	1006	–	1.5	TD
	05/18	15.8	146.6	1006	–	1.5	TD
	06/00	16.6	145.6	1008	–	1.5	TD
	06/06	17.8	145.2	1004	35	2.0	TS
	06/12	18.5	145.4	1004	35	2.0	TS
	06/18	19.4	145.7	1004	35	2.0	TS
	07/00	20.9	146.0	1004	35	2.0	TS
	07/06	21.8	146.6	1004	35	2.0	TS
	07/12	23.0	147.1	1004	35	2.0	TS
	07/18	23.4	147.2	1002	35	1.5	TS
	08/00	23.9	147.0	1002	35	1.5	TS
	08/06	24.0	147.0	1000	35	1.5	TS
	08/12	24.0	147.4	1000	35	1.5	TS
	08/18	24.6	148.2	1000	35	1.5	TS
	09/00	25.9	149.0	1000	35	1.5	TS
	09/06	27.6	149.4	998	35	2.0	TS
	09/12	29.7	149.2	998	35	2.0	TS
	09/18	31.5	149.3	996	35	2.0	TS
	10/00	32.7	150.1	996	40	2.0	TS
	10/06	34.7	150.9	994	40	2.0	TS
	10/12	36.5	152.7	990	40	2.0	TS
	10/18	39.2	154.2	985	45	2.0	TS
	11/00	42.0	154.0	982	–	2.0	L
	11/06	44.6	154.0	980	–	–	L
	11/12	46.3	153.3	976	–	–	L
	11/18	47.5	153.4	978	–	–	L
	12/00	48.6	154.4	984	–	–	L
	12/06	48.9	155.6	988	–	–	L
	12/12	49.2	158.1	992	–	–	L
	12/18	49.9	160.9	996	–	–	L
	13/00	50.6	162.9	998	–	–	L
	13/06	51.7	164.2	1000	–	–	L
	13/12	52.9	163.0	1000	–	–	L
	13/18	53.1	160.9	998	–	–	L
	14/00	53.1	161.8	996	–	–	L
	14/06	52.5	163.3	996	–	–	L
	14/12	51.1	165.1	1000	–	–	L
	14/18	49.6	168.7	1000	–	–	L
	15/00	48.2	172.2	1000	–	–	L
	15/06	48.2	177.4	1000	–	–	L
	15/12	48.6	180.4	1000	–	–	Out

STS TRAMI (2420)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Oct.	18/12	13.2	141.0	1008	–	–	TD
	18/18	13.5	139.9	1006	–	–	TD
	19/00	13.7	139.3	1008	–	–	TD
	19/06	13.8	138.9	1004	–	–	TD
	19/12	14.2	138.2	1006	–	0.0	TD
	19/18	14.2	138.1	1004	–	0.0	TD
	20/00	14.2	137.5	1004	–	0.0	TD
	20/06	14.1	136.8	1002	–	0.5	TD
	20/12	14.0	135.3	1002	–	1.0	TD
	20/18	13.8	134.0	1000	–	1.5	TD
	21/00	14.1	132.3	1000	–	1.5	TD
	21/06	13.7	130.6	998	–	1.5	TD
	21/12	13.1	129.1	998	–	1.5	TD
	21/18	13.2	128.3	994	35	2.0	TS
	22/00	13.8	127.5	994	35	2.5	TS
	22/06	14.0	126.6	990	45	2.5	TS
	22/12	14.5	126.0	990	45	2.5	TS
	22/18	15.2	125.6	990	45	2.5	TS
	23/00	15.6	124.4	985	50	2.5	STS
	23/06	16.4	123.5	985	50	2.5	STS
	23/12	16.9	123.0	985	50	3.0	STS
	23/18	17.2	122.2	985	50	3.0	STS
	24/00	16.9	121.2	985	50	3.0	STS
	24/06	17.4	120.1	985	50	3.0	STS
	24/12	17.2	119.8	985	50	3.0	STS
	24/18	17.2	119.5	985	50	3.0	STS
	25/00	17.1	118.4	985	50	3.0	STS
	25/06	17.8	117.0	985	50	3.0	STS
	25/12	17.3	116.2	985	50	3.0	STS
	25/18	17.1	114.9	985	50	3.0	STS
	26/00	17.1	113.2	975	55	3.0	STS
	26/06	17.1	111.9	970	60	3.0	STS
	26/12	17.0	110.7	975	55	3.0	STS
	26/18	17.0	109.3	980	50	3.0	STS
	27/00	16.8	108.6	985	45	3.0	TS
	27/06	15.7	107.6	992	40	3.0	TS
	27/12	15.3	107.5	998	35	3.0	TS
	27/18	15.4	107.8	1002	–	2.5	TD
	28/00	15.6	108.0	1004	–	2.5	TD
	28/06	15.7	108.2	1002	–	–	TD
	28/12	16.2	108.4	1004	–	–	TD
	28/18	16.6	108.7	1004	–	–	TD
	29/00	16.7	109.0	1004	–	–	TD
	29/06	16.8	109.3	1004	–	–	TD
	29/12	16.9	109.5	1004	–	–	TD
	29/18						Dissip.

TY KONG-REY (2421)

Date/Time		Center Position		Central pressure	Max Wind	CI num.	Grade
	(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Oct.	24/00	12.7	150.1	1002	–	0.0	TD
	24/06	13.0	148.3	1000	–	0.5	TD
	24/12	13.5	147.1	1000	–	1.0	TD
	24/18	13.5	145.7	998	35	1.5	TS
	25/00	14.4	144.5	998	35	1.5	TS
	25/06	14.9	142.6	998	35	1.5	TS
	25/12	15.3	141.0	998	35	1.5	TS
	25/18	16.4	139.7	996	35	2.0	TS
	26/00	16.3	137.2	996	35	2.0	TS
	26/06	16.6	135.3	994	35	2.0	TS
	26/12	16.2	134.6	994	35	2.0	TS
	26/18	16.0	133.3	994	40	2.5	TS
	27/00	16.0	132.6	994	40	3.0	TS
	27/06	16.1	131.8	990	45	3.0	TS
	27/12	16.1	131.1	985	50	3.5	STS
	27/18	16.5	130.3	985	50	3.5	STS
	28/00	16.8	129.6	980	55	3.5	STS
	28/06	16.6	128.9	975	60	3.5	STS
	28/12	16.6	128.4	975	60	3.5	STS
	28/18	17.2	128.0	970	65	4.0	TY
	29/00	17.5	127.3	960	75	5.0	TY
	29/06	17.9	126.7	950	80	5.0	TY
	29/12	18.6	126.1	945	85	6.0	TY
	29/18	18.9	125.4	935	90	6.0	TY
	30/00	19.1	124.8	925	100	6.5	TY
	30/06	19.8	124.3	935	95	6.5	TY
	30/12	20.4	123.6	940	90	6.5	TY
	30/18	21.0	122.8	940	90	6.5	TY
	30/21	21.6	122.5	940	90	–	TY
	31/00	21.9	122.1	950	85	6.0	TY
	31/03	22.4	121.7	950	85	–	TY
	31/06	23.2	121.3	960	75	6.0	TY
	31/12	24.1	120.2	980	55	5.0	STS
	31/18	25.0	120.2	990	45	5.0	TS
Nov.	01/00	26.4	120.6	994	40	4.5	TS
	01/06	28.3	121.6	996	40	4.0	TS
	01/12	30.1	123.4	998	–	3.5	L
	01/18	31.1	125.4	1000	–	–	L
	02/00	31.0	128.0	1004	–	–	L
	02/06						Dissip.

TY YINXING (2422)

Date/Time	Center Position		Central pressure	Max Wind	CI num.	Grade
(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Nov. 02/18	8.2	140.0	1006	–	0.5	TD
03/00	8.9	139.0	1006	–	1.0	TD
03/06	9.9	138.1	1004	–	1.5	TD
03/12	11.0	136.1	1002	35	2.0	TS
03/18	11.4	134.5	998	40	2.5	TS
04/00	12.1	132.8	998	40	2.5	TS
04/06	12.9	131.4	996	45	3.0	TS
04/12	14.1	130.3	992	55	3.5	STS
04/18	15.3	128.9	985	65	4.0	TY
05/00	16.1	127.6	975	75	5.0	TY
05/06	17.1	126.4	975	75	5.0	TY
05/12	17.3	125.6	970	80	5.0	TY
05/18	17.8	125.0	970	80	5.0	TY
06/00	18.1	124.8	970	80	5.0	TY
06/06	18.1	124.4	965	85	5.5	TY
06/12	18.2	124.1	960	90	6.0	TY
06/18	18.3	123.6	950	95	6.0	TY
07/00	18.6	123.1	950	95	6.0	TY
07/06	18.5	122.4	945	100	6.5	TY
07/12	18.7	121.5	965	85	5.5	TY
07/18	18.6	120.5	970	80	5.0	TY
08/00	18.3	119.4	980	70	4.5	TY
08/06	18.4	118.1	980	70	4.5	TY
08/12	18.4	116.9	975	75	4.5	TY
08/18	18.6	115.9	970	80	5.0	TY
09/00	18.9	114.9	965	85	5.5	TY
09/06	19.0	114.1	965	85	5.5	TY
09/12	19.1	113.6	965	85	5.5	TY
09/18	19.2	113.3	965	85	5.5	TY
10/00	19.0	113.2	975	75	5.0	TY
10/06	19.0	113.0	980	70	4.5	TY
10/12	18.6	112.7	990	60	4.0	STS
10/18	17.9	112.3	994	50	3.5	STS
11/00	17.3	111.5	994	50	3.0	STS
11/06	16.4	111.0	994	50	3.0	STS
11/12	15.7	110.6	998	40	2.5	TS
11/18	14.9	110.0	1000	35	2.0	TS
12/00	14.3	109.7	1002	35	2.0	TS
12/06	14.1	109.4	1004	–	2.0	TD
12/12	14.0	108.7	1008	–	2.0	TD
12/18						Dissip.

TY TORAJI (2423)

Date/Time	Center Position		Central pressure	Max Wind	CI num.	Grade
(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Nov. 08/06	14.5	137.6	1006	–	0.5	TD
08/12	14.5	136.0	1008	–	0.5	TD
08/18	14.5	134.7	1008	–	1.0	TD
09/00	14.5	133.3	1006	–	1.5	TD
09/06	14.6	131.6	1002	35	2.0	TS
09/12	14.7	130.3	1000	40	2.5	TS
09/18	15.1	128.3	998	45	3.0	TS
10/00	15.1	126.9	996	50	3.5	STS
10/06	15.2	125.4	990	60	3.5	STS
10/12	15.5	124.3	985	65	4.0	TY
10/18	15.9	123.2	980	70	5.0	TY
11/00	16.3	122.3	980	70	4.5	TY
11/06	17.1	121.1	990	55	4.5	STS
11/12	17.4	119.7	992	50	4.0	STS
11/18	18.2	119.1	992	50	3.5	STS
12/00	18.6	118.7	992	50	3.0	STS
12/06	19.1	118.2	994	45	2.5	TS
12/12	19.5	117.8	994	45	2.5	TS
12/18	19.9	117.1	994	45	2.0	TS
13/00	20.2	116.3	996	40	1.5	TS
13/06	20.7	115.5	996	40	1.5	TS
13/12	21.0	114.9	998	40	1.5	TS
13/18	21.1	114.5	998	40	1.5	TS
14/00	21.1	114.1	1000	35	1.5	TS
14/06	21.2	113.9	1000	35	1.5	TS
14/12	21.2	113.6	1004	–	1.0	TD
14/18	21.1	113.1	1006	–	1.0	TD
15/00	20.9	113.0	1008	–	1.0	TD
15/06	20.6	113.2	1008	–	1.0	TD
15/12	20.3	113.7	1008	–	1.0	TD
15/18						Dissip.

TY MAN-YI (2424)

Date/Time	Center Position		Central pressure	Max Wind	CI num.	Grade
(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Nov. 07/18	10.3	168.5	1008	–	–	TD
08/00	11.0	166.4	1008	–	0.0	TD
08/06	11.7	165.1	1006	–	0.0	TD
08/12	11.9	163.6	1008	–	0.5	TD
08/18	12.2	161.9	1004	35	1.0	TS
09/00	13.5	160.4	1004	35	1.5	TS
09/06	14.5	159.3	1004	35	1.5	TS
09/12	15.0	158.7	1002	40	2.0	TS
09/18	15.7	157.7	1000	45	2.0	TS
10/00	15.8	156.3	1000	45	2.0	TS
10/06	15.6	155.7	1000	45	2.0	TS
10/12	15.6	155.3	1000	45	2.0	TS
10/18	15.3	154.7	1000	45	2.0	TS
11/00	14.8	153.2	1000	45	2.0	TS
11/06	14.3	152.6	1000	45	2.0	TS
11/12	14.1	152.1	1000	45	2.0	TS
11/18	13.6	151.1	1000	45	2.0	TS
12/00	13.8	149.3	1000	45	2.0	TS
12/06	14.2	147.5	1002	40	2.0	TS
12/12	13.6	146.3	1002	40	2.0	TS
12/18	12.9	145.0	1002	40	2.0	TS
13/00	12.2	144.3	1002	40	2.0	TS
13/06	12.0	143.6	1002	40	2.0	TS
13/12	12.4	141.3	1002	40	2.5	TS
13/18	11.1	139.7	998	45	3.0	TS
14/00	10.6	138.0	992	55	3.5	STS
14/06	10.2	137.1	992	55	3.5	STS
14/12	10.5	135.4	992	55	3.5	STS
14/18	10.4	133.5	985	60	4.0	STS
15/00	10.5	131.9	975	70	5.0	TY
15/06	10.9	130.4	960	80	5.5	TY
15/12	11.4	129.0	955	85	6.0	TY
15/18	12.0	127.8	940	95	6.5	TY
16/00	12.6	126.7	920	105	7.0	TY
16/06	13.3	125.6	920	105	7.0	TY
16/12	13.9	124.6	920	105	7.0	TY
16/18	14.3	123.8	935	100	7.0	TY
17/00	15.0	122.9	935	100	7.0	TY
17/06	15.8	121.9	935	100	7.0	TY
17/12	16.5	120.7	955	85	6.0	TY
17/18	17.6	119.4	975	70	5.5	TY
18/00	18.1	118.4	980	65	5.0	TY
18/06	18.5	117.3	980	65	5.0	TY
18/12	18.9	116.0	985	60	4.5	STS
18/18	19.0	115.4	992	50	4.0	STS
19/00	19.0	114.7	998	45	3.5	TS
19/06	18.7	113.3	1004	35	3.0	TS
19/12	18.1	112.0	1010	–	2.0	TD
19/18	17.5	111.4	1012	–	1.5	TD
20/00	16.5	110.6	1012	–	1.5	TD
20/06						Dissip.

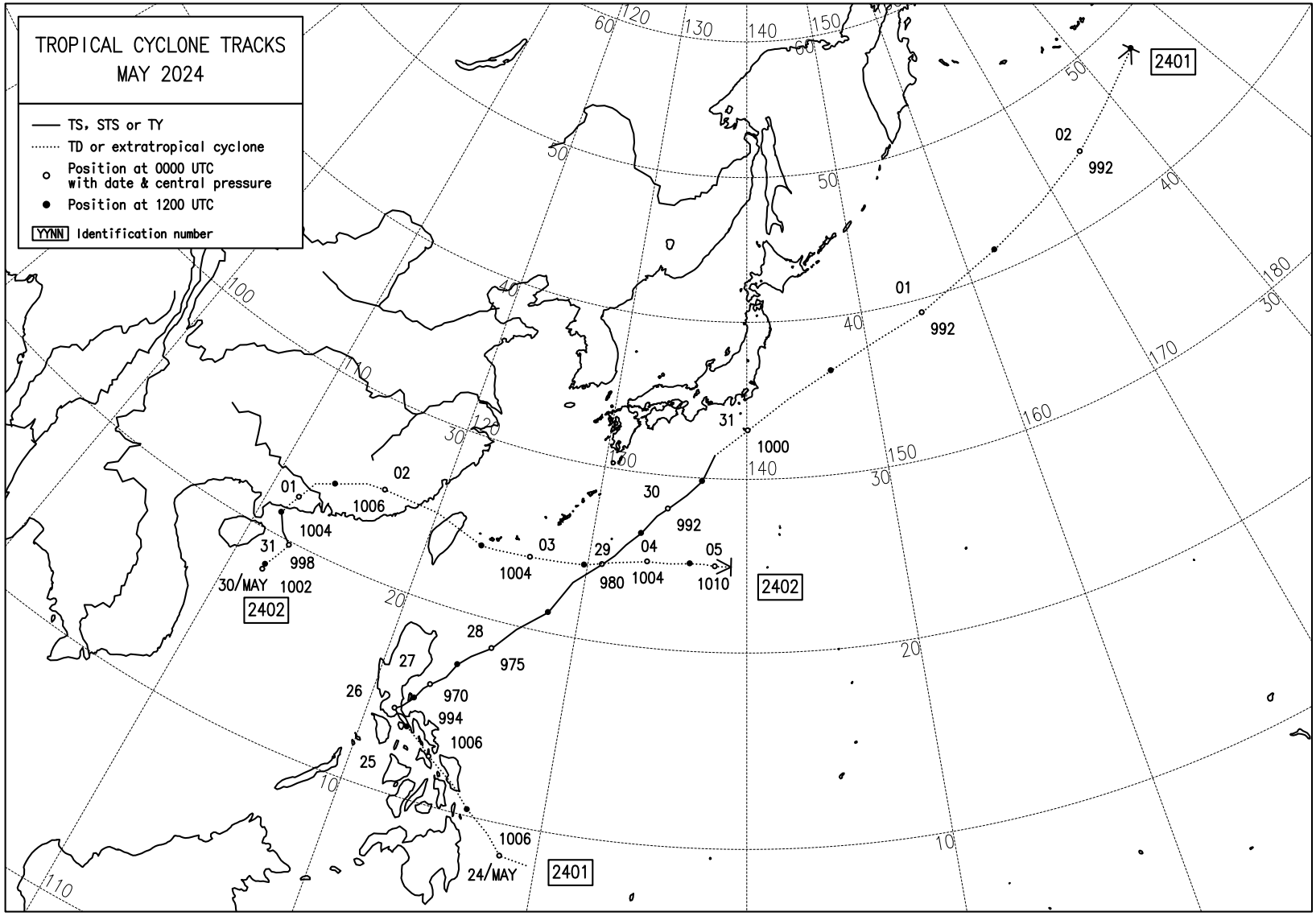
TY USAGI (2425)

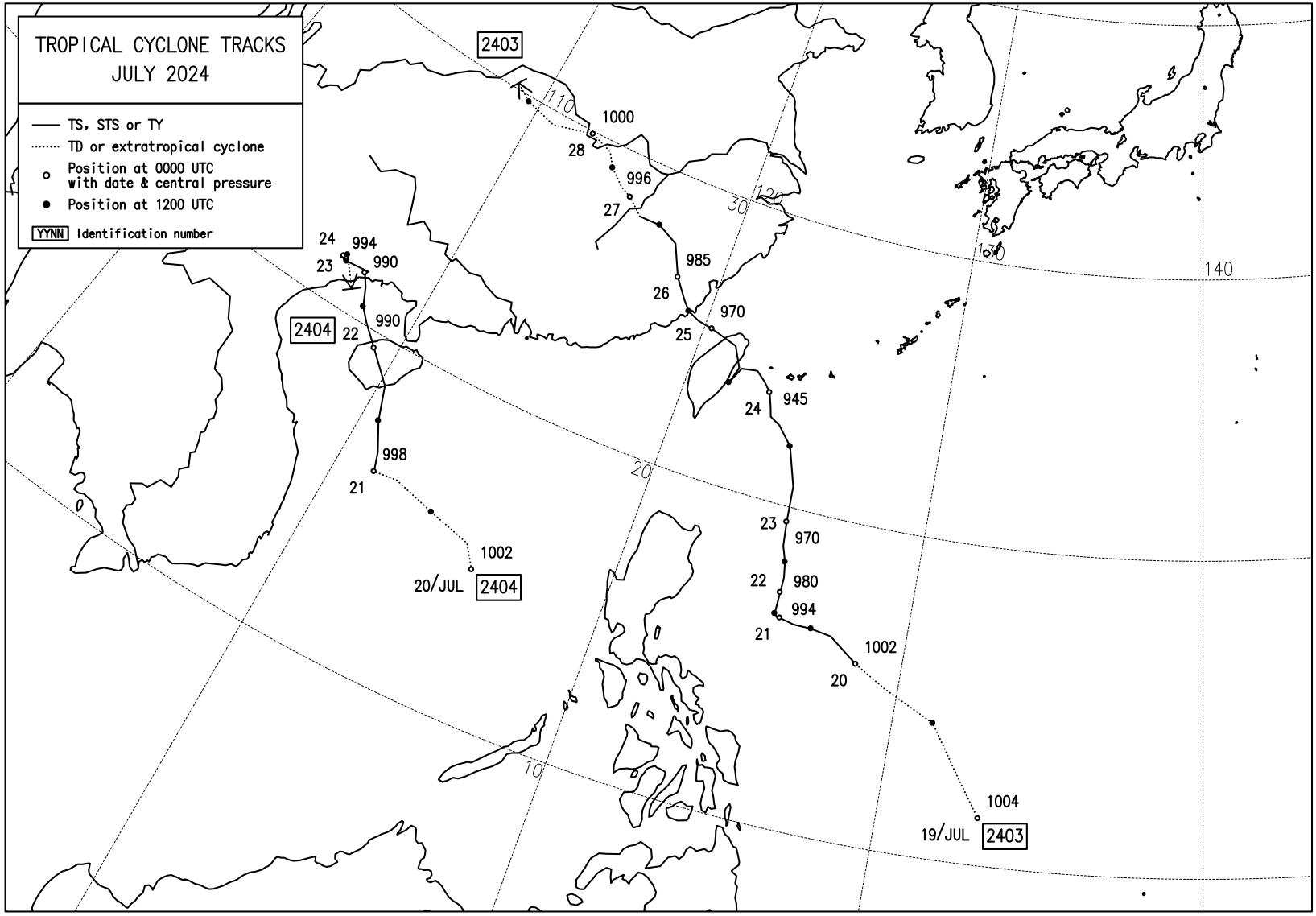
Date/Time	Center Position		Central pressure	Max Wind	CI num.	Grade
(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Nov. 09/00	6.7	151.4	1008	–	0.0	TD
09/06	7.3	150.3	1006	–	0.0	TD
09/12	7.9	149.1	1006	–	0.0	TD
09/18	8.0	147.9	1006	–	0.5	TD
10/00	9.5	146.3	1006	–	0.5	TD
10/06	10.3	144.3	1006	–	0.5	TD
10/12	10.9	142.5	1006	–	1.0	TD
10/18	11.3	140.8	1004	–	1.0	TD
11/00	11.7	139.9	1004	–	1.0	TD
11/06	12.2	138.5	1004	–	1.5	TD
11/12	12.4	136.7	1004	–	2.0	TD
11/18	12.6	135.0	1002	35	2.5	TS
12/00	13.4	133.5	996	45	2.5	TS
12/06	14.0	131.9	992	50	3.0	STS
12/12	14.2	130.5	990	55	3.5	STS
12/18	14.6	129.0	990	55	3.5	STS
13/00	15.0	127.9	980	65	4.0	TY
13/06	15.7	126.4	970	75	4.5	TY
13/12	16.2	125.3	960	80	5.0	TY
13/18	16.6	124.0	950	90	6.0	TY
14/00	17.2	123.1	940	95	6.0	TY
14/06	17.8	122.2	955	85	5.5	TY
14/12	18.7	121.5	980	65	5.0	TY
14/18	19.3	120.9	985	60	5.0	STS
15/00	20.0	120.3	990	55	4.5	STS
15/06	20.9	120.1	992	50	4.0	STS
15/12	21.4	120.1	994	45	3.5	TS
15/18	21.9	120.2	998	40	3.0	TS
16/00	22.3	120.4	1006	–	2.5	TD
16/06	22.4	120.5	1006	–	2.0	TD
16/12	22.2	120.5	1008	–	–	TD
16/18						Dissip.

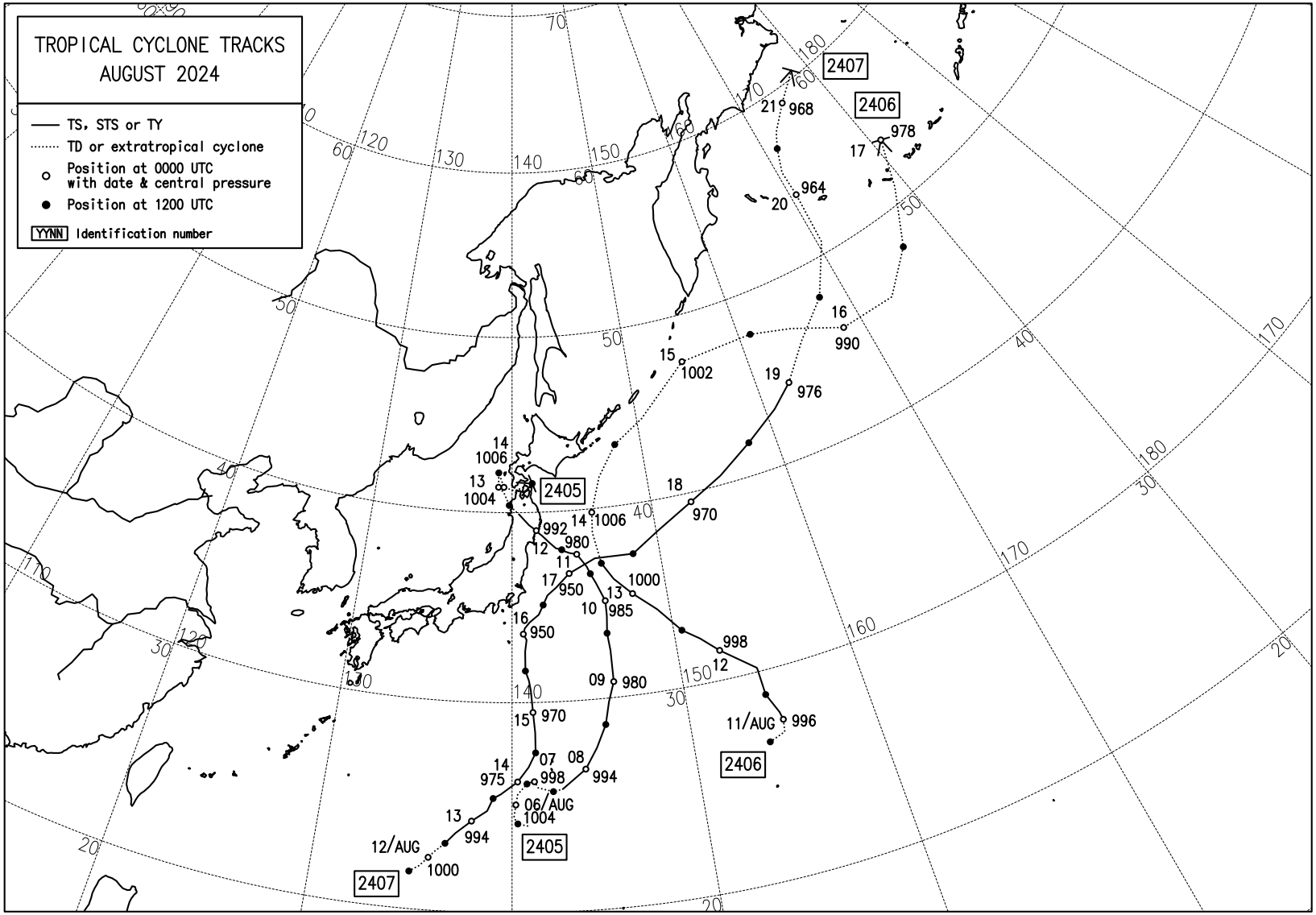
TS PABUK (2426)

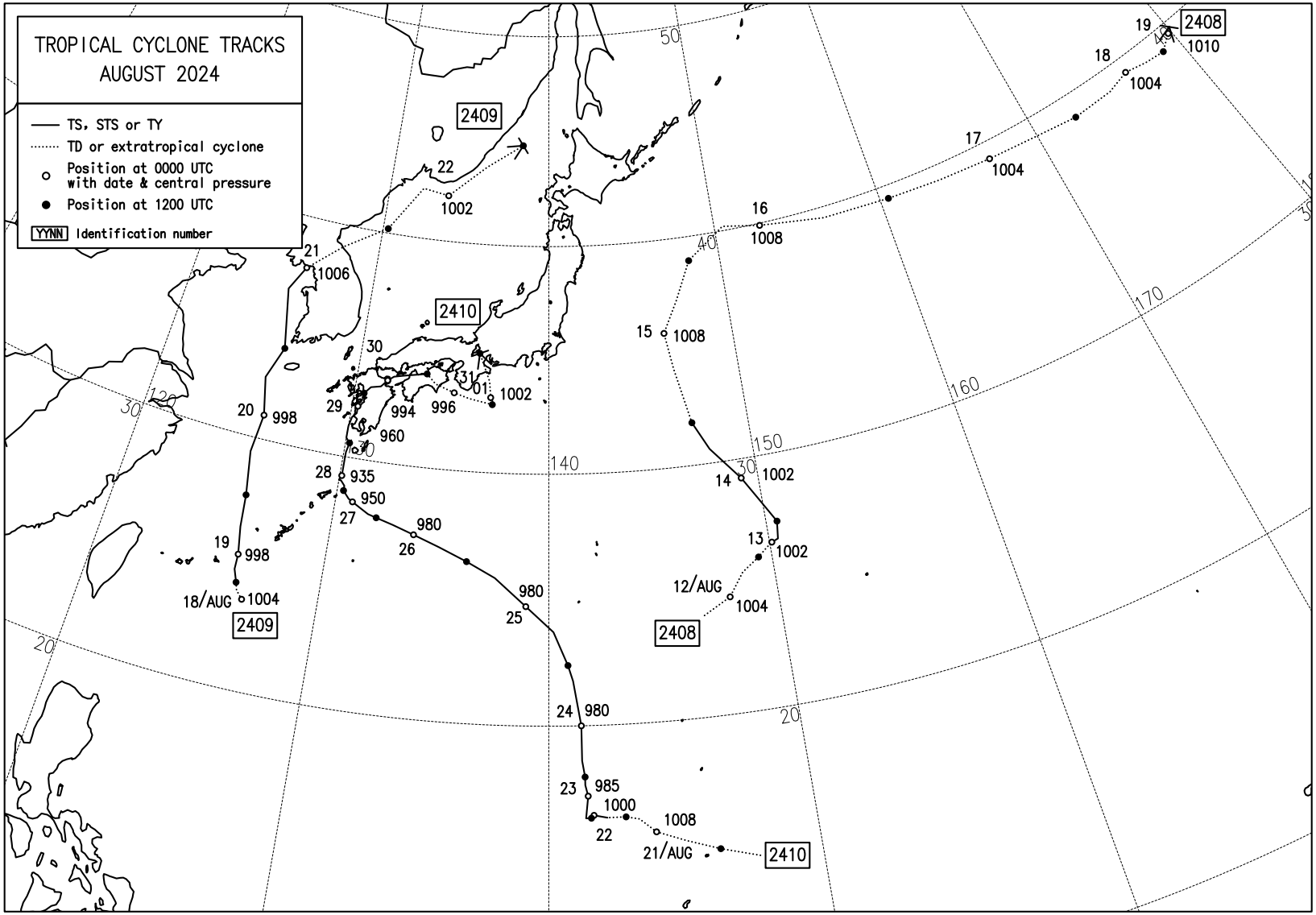
Date/Time	Center Position		Central pressure	Max Wind	CI num.	Grade
(UTC)	Lat (N)	Lon (E)	(hPa)	(kt)		
Dec. 21/18	10.1	115.3	1004	–	1.0	TD
22/00	10.3	114.8	1006	–	1.5	TD
22/06	10.5	114.2	1002	35	2.0	TS
22/12	10.6	113.7	1002	35	2.0	TS
22/18	10.6	113.3	1002	35	2.0	TS
23/00	11.2	112.9	1002	35	2.0	TS
23/06	11.2	112.6	1002	35	1.5	TS
23/12	11.5	112.6	1002	35	1.5	TS
23/18	11.6	112.4	1002	35	1.5	TS
24/00	11.5	112.2	1002	35	2.0	TS
24/06	11.5	112.1	1002	35	2.0	TS
24/12	11.4	111.9	1002	35	2.0	TS
24/18	11.1	111.3	1006	–	2.0	TD
25/00	10.6	110.7	1006	–	2.0	TD
25/06	9.7	110.3	1006	–	1.5	TD
25/12	9.4	110.2	1008	–	1.5	TD
25/18						Dissip.

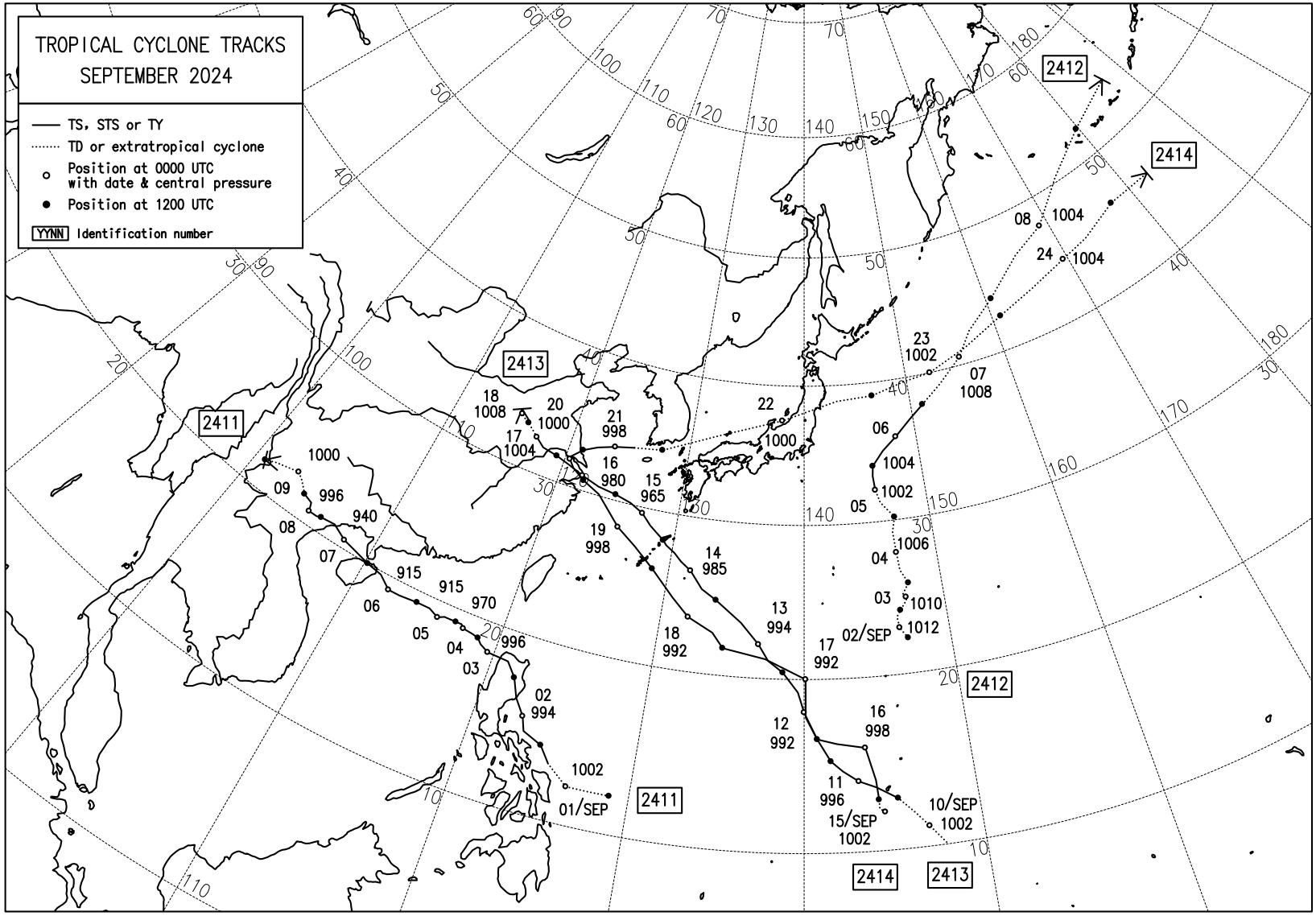
Appendix 2
Monthly Tracks of Tropical Cyclones in 2024

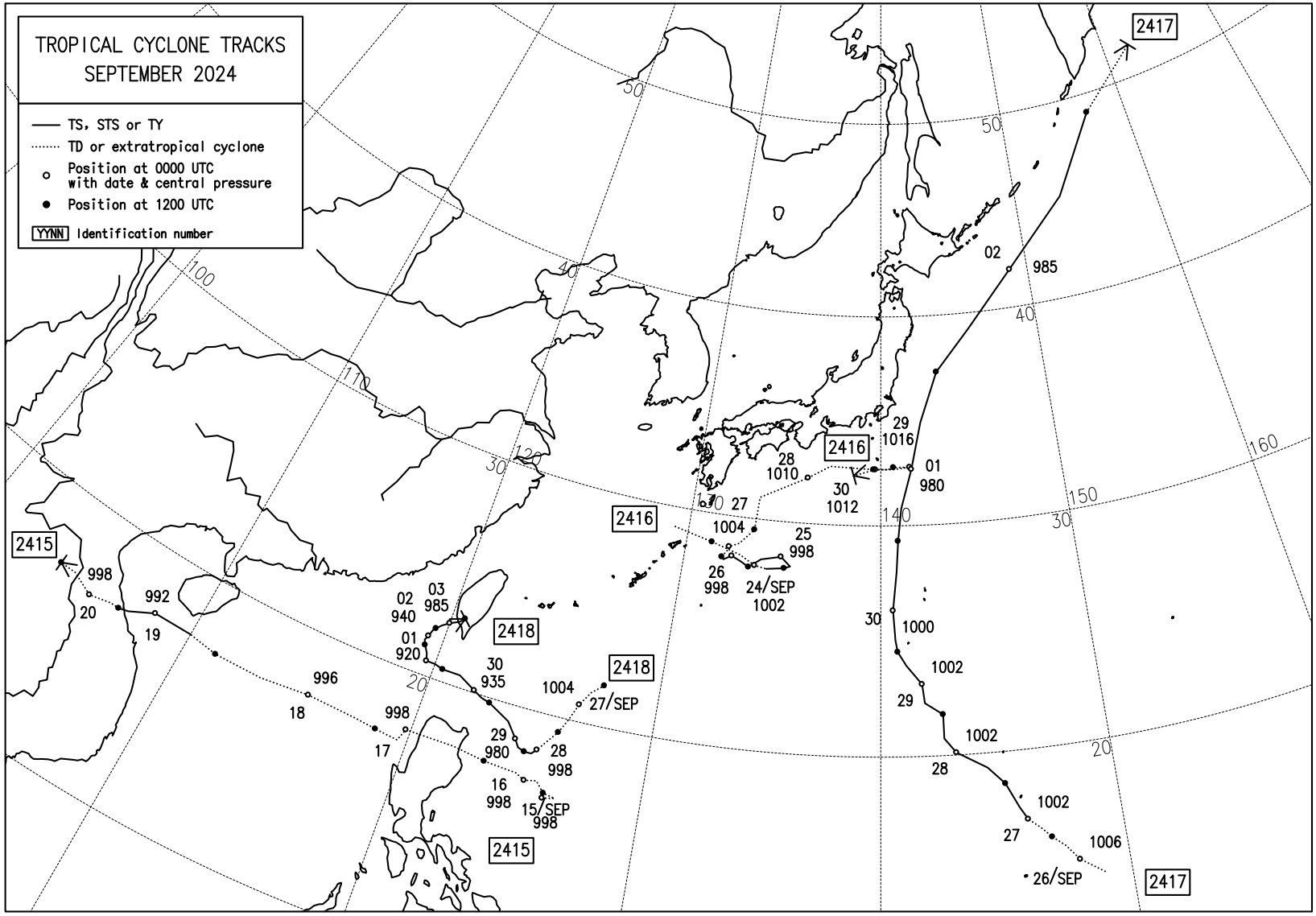

TROPICAL CYCLONE TRACKS
MAY 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
2401
02
992
01
992
31
1000
30
992
03
1004
29
980
04
1004
05
1010
2402
01
1006
02
1004
31
998
30/MAY
1002
2402
28
975
27
26
970
994
1006
25
1006
24/MAY
2401

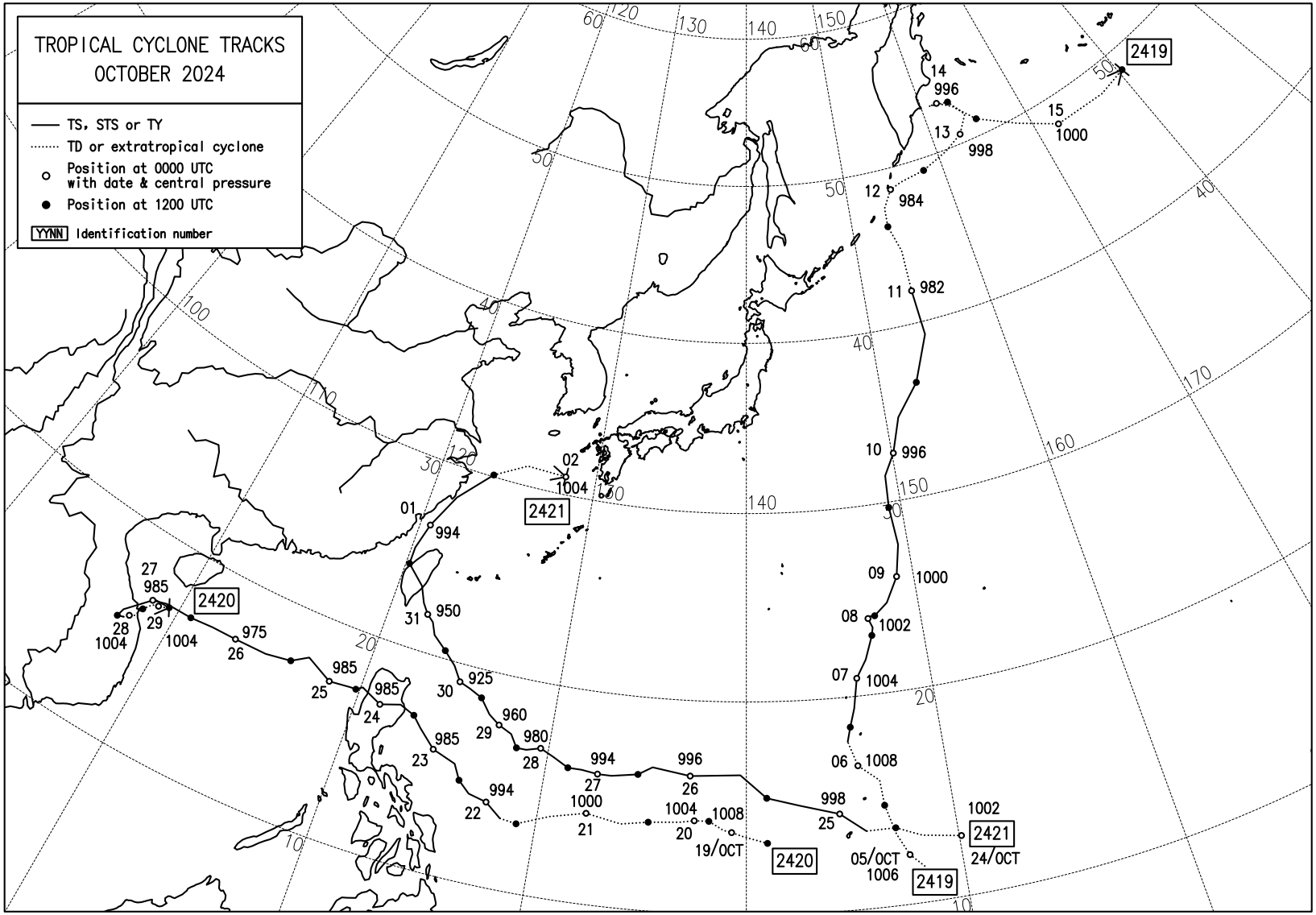

TROPICAL CYCLONE TRACKS
JULY 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
2403
1000
28
996
27
985
26
970
25
945
24
2404
994
24
23
990
990
22
998
21
1002
20/JUL
2404
970
23
980
22
994
21
1002
20
1004
19/JUL
2403
110
120
130
140
170
20
10

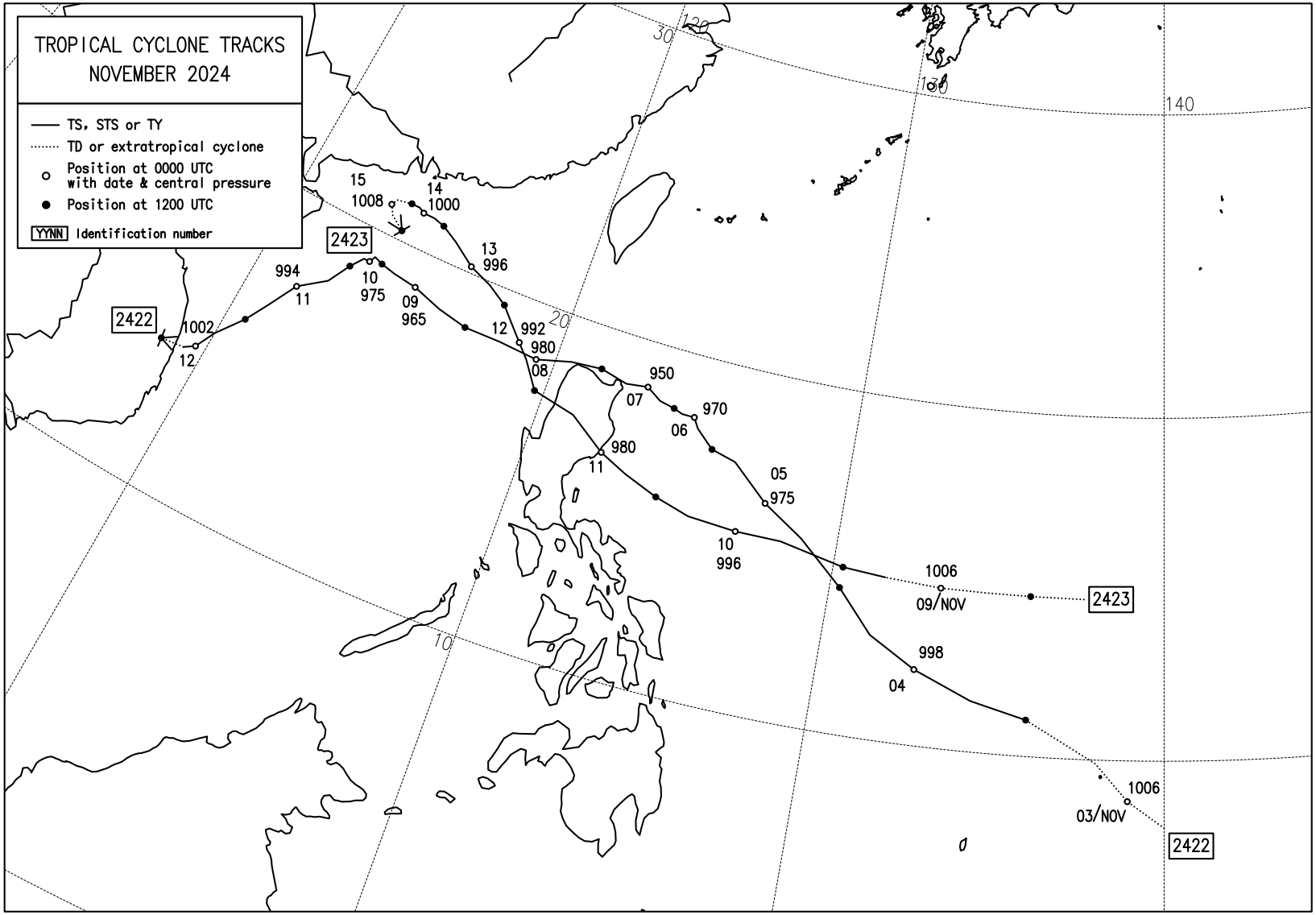

TROPICAL CYCLONE TRACKS
AUGUST 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
2407
2406
2405
2407
2406
2405
11/AUG
12/AUG
06/AUG

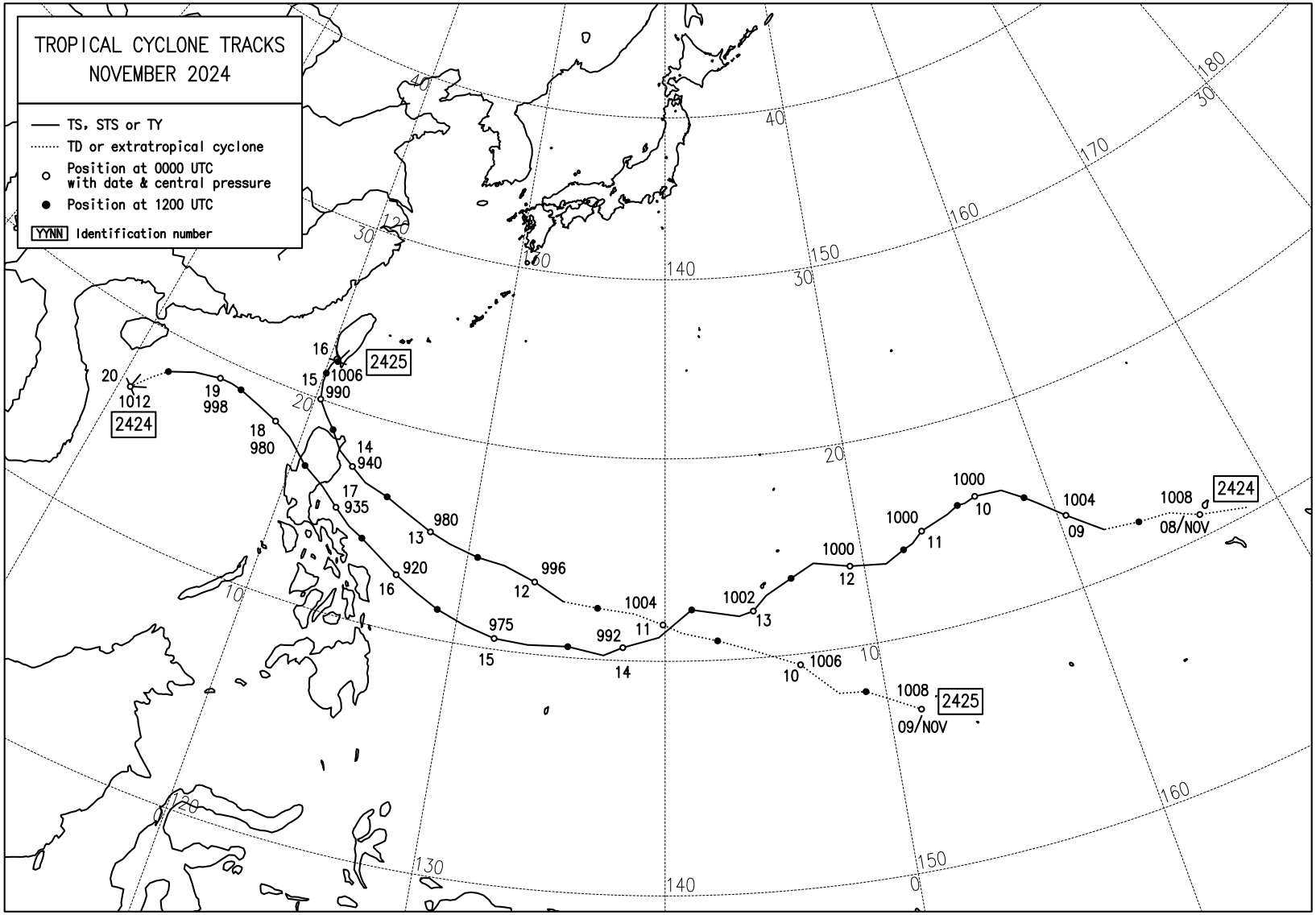

TROPICAL CYCLONE TRACKS
AUGUST 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
2409
2410
2408
1002
1006
1008
1004
1010
998
994
996
960
935
950
980
985
1000
18/AUG
12/AUG
21/AUG
50
40
30
20
120
130
140
150
160
170

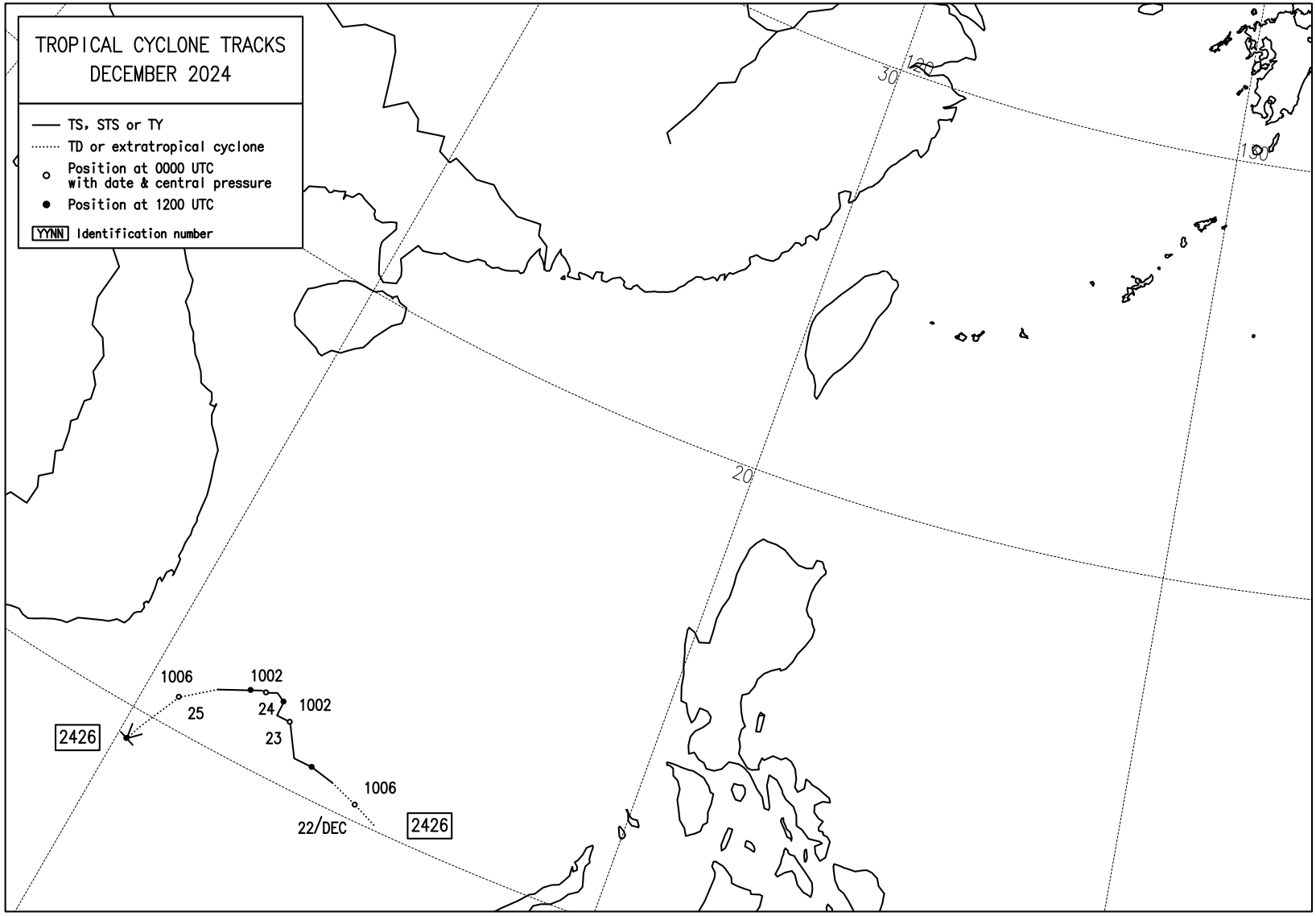

TROPICAL CYCLONE TRACKS
SEPTEMBER 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
2411
2412
2413
2414
1000
09 996
940
08
07 915
915
970
06
05 996
04
03
02 994
1002
01/SEP
18 1008
20 1000
17 1004
21 998
16 980
15 965
19 998
14 985
13 994
18 992
17 992
12 992
11 996
15/SEP 1002
10/SEP 1002
16 998
22 1000
23 1002
07 1008
06
1004
1002
05
1006
04
03 1010
1012
02/SEP
08 1004
24 1004


TROPICAL CYCLONE TRACKS
SEPTEMBER 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
2415
2416
2417
2418
998
20
992
19
996
18
998
17
16
998
15/SEP
998
02
940
03
985
01
920
30
935
1004
27/SEP
29
980
28
998
2418
2415
2416
28
1010
29
1016
30
1012
01
980
27
1004
25
998
26
998
24/SEP
1002
02
985
30
1000
1002
29
1002
28
1002
27
1006
26/SEP
2417
100
110
120
130
140
150
160
170
40
50
20
30


TROPICAL CYCLONE TRACKS
OCTOBER 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
2419
2421
2420
2419
2421
2420
24/0CT
19/0CT
05/0CT


TROPICAL CYCLONE TRACKS
NOVEMBER 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC with date & central pressure
Position at 1200 UTC
YYNN Identification number
30
20
10
120
130
140
2422
2423
1002
12
994
11
10
975
09
965
15
1008
14
1000
13
996
12
992
980
08
950
07
970
06
980
11
05
975
10
996
1006
09/NOV
998
04
1006
03/NOV


TROPICAL CYCLONE TRACKS
NOVEMBER 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
2424
2425
08/NOV
09/NOV


TROPICAL CYCLONE TRACKS
DECEMBER 2024
TS, STS or TY
TD or extratropical cyclone
Position at 0000 UTC
with date & central pressure
Position at 1200 UTC
YYNN Identification number
30
120
150
20
1006
1002
1002
25
24
23
2426
1006
22/DEC
2426

Appendix 3
Errors of Track and Intensity Forecasts for Each Tropical Cyclone in 2024

Date/Time (UTC)		Grade Best	Grade Prov.	Center Position (km) T=0‡	=24	=48	=72	=96	=120	Central Pressure (hPa) T=24	=48	=72	=96	=120	Max. Wind Speed (kt)† T=24	=48	=72	=96	=120
									Ewiniar(2401)										
May.	23/18	TD	TD	*25*	*110*	*240*	*195*	*230*	*227*	*-4*	*0*	*15*	*10*	*5*	*5*	*-5*	*-20*	*-10*	*-5*
	24/00	TD	TD	*91*	*233*	*263*	*232*	*331*	*366*	*-8*	*0*	*15*	*0*	*-5*	*10*	*-5*	*-20*	*0*	*5*
	24/06	TD	TD	*112*	*124*	*179*	*177*	*338*	*496*	*-4*	*8*	*15*	*0*	*-5*	*5*	*-15*	*-15*	*0*	*5*
	24/12	TD	TD	*98*	*132*	*117*	*170*	*269*	*398*	*-2*	*18*	*15*	*0*	*-10*	*0*	*-25*	*-15*	*0*	*10*
	24/18	TD	TD	*35*	*117*	*70*	*123*	*211*	*493*	*2*	*19*	*15*	*0*	*-10*	*-10*	*-25*	*-15*	*0*	*10*
	25/00	TD	TD	*0*	*124*	*108*	*222*	*396*	*1192*	*6*	*22*	*5*	*0*	*-2*	*-15*	*-30*	*-5*	*0*	*5*
	25/06	TD	TD	*45*	*44*	*68*	*113*	*172*	*234*	*12*	*22*	*5*	*0*	*-6*	*-20*	*-25*	*-5*	*0*	*10*
	25/12	TS	TD	**57**	**11**	**67**	**61**	**156**	**261**	**22**	**22**	**10**	**0**	**-4**	**-30**	**-25**	**-10**	**0**	**5**
	25/18	TS	TD	**69**	**21**	**92**	**42**	**119**		**21**	**20**	**10**	**0**		**-30**	**-20**	**-10**	**0**	
	26/00	STS	TS	**24**	**70**	**124**	**49**	**95**		**24**	**10**	**0**	**-2**		**-30**	**-10**	**0**	**5**	
	26/06	STS	TS	**0**	**56**	**80**	**139**	**145**		**22**	**5**	**0**	**-6**		**-20**	**-5**	**0**	**10**	
	26/12	TY	TS	**0**	**34**	**53**	**83**	**111**		**22**	**0**	**-5**	**-6**		**-20**	**0**	**5**	**10**	
	26/18	TY	STS	**0**	**84**	**89**	**56**			**20**	**0**	**-5**			**-15**	**0**	**5**		
	27/00	TY	TY	**0**	**54**	**45**	**85**			**0**	**-15**	**-7**			**5**	**15**	**10**		
	27/06	TY	TY	**35**	**24**	**73**	**15**			**-5**	**-10**	**-11**			**10**	**10**	**15**		
	27/12	TY	TY	**64**	**38**	**67**	**106**			**-5**	**-15**	**-11**			**10**	**15**	**15**		
	27/18	TY	TY	**33**	**69**	**78**				**-5**	**-15**				**10**	**15**			
	28/00	TY	TY	**25**	**73**	**46**				**-10**	**-12**				**15**	**15**			
	28/06	TY	TY	**46**	**35**	**0**				**-10**	**-16**				**15**	**20**			
	28/12	TY	TY	**69**	**37**	**10**				**-10**	**-11**				**15**	**15**			
	28/18	TY	TY	**89**	**82**					**-5**					**10**				
	29/00	STS	TY	**20**	**39**					**-2**					**10**				
	29/06	STS	STS	**0**	**40**					**-4**					**10**				
	29/12	STS	STS	**30**	**59**					**-4**					**5**				
	29/18	STS	STS	**44**															
	30/00	TS	STS	**59**															
	30/06	TS	TS	**29**															
	30/12	TS	TS	**29**															
Initial: TS/STS/TY		**mean**		**34**	**49**	**63**	**71**	**125**	**261**	**4**	**-3**	**-2**	**-3**	**-4**	**-2**	**3**	**3**	**5**	**5**
Valid: TS/STS/TY		**sample**		**21**	**17**	**13**	**9**	**5**	**1**	**17**	**13**	**9**	**5**	**1**	**17**	**13**	**9**	**5**	**1**
Initial: TD(before upg.)		*mean*		*58*	*126*	*149*	*176*	*278*	*486*	*0*	*13*	*12*	*1*	*-5*	*-4*	*-19*	*-14*	*-1*	*6*
Valid: TD/TS/STS/TY		*sample*		*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time (UTC)		Grade Best	Grade Prov.	Center Position (km) T=0‡	=24	=48	=72	=96	=120	Central Pressure (hPa) T=24	=48	=72	=96	=120	Max. Wind Speed (kt)† T=24	=48	=72	=96	=120
									Maliksi(2402)										
May.	30/06	TD	TD	*135*	*91*	*140*				*0*	*-4*				*0*	*5*			
	30/12	TD	TD	*11*	*114*	*70*				*-2*	*-2*				*5*	*0*			
	30/18	TD	TD	*32*	*72*	*39*				*-2*	*-4*				*5*	*0*			
	31/00	TS	TD	**98**															
	31/06	TS	TS	**39**															
Initial: TS/STS/TY		**mean**		**69**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Valid: TS/STS/TY		**sample**		**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial: TD(before upg.)		*mean*		*59*	*93*	*83*	*--*	*--*	*--*	*-1*	*-3*	*--*	*--*	*--*	*3*	*2*	*--*	*--*	*--*
Valid: TD/TS/STS/TY		*sample*		*3*	*3*	*3*	*0*	*0*	*0*	*3*	*3*	*0*	*0*	*0*	*3*	*3*	*0*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Gaemi(2403)											
Jul.	19/12	TD	TD	*62*	*250*	*183*	*95*	*159*	*397*	*0*	*0*	*5*	*5*	*-5*	*-5*	*-5*	*-10*	*-5*	*15*
	19/18	TD	TD	*108*	*204*	*149*	*124*	*243*	*344*	*0*	*7*	*10*	*20*	*-15*	*-5*	*-15*	*-15*	*-15*	*20*
	20/00	TS	TD	**92**	**193**	**99**	**57**	**253**	**353**	**4**	**12**	**15**	**30**	**-5**	**-10**	**-20**	**-20**	**-20**	**15**
	20/06	TS	TS	**110**	**189**	**96**	**109**	**278**	**375**	**4**	**10**	**5**	**30**	**-25**	**-10**	**-15**	**-15**	**-20**	**25**
	20/12	TS	TS	**63**	**138**	**119**	**237**	**447**	**464**	**-2**	**0**	**-5**	**-15**	**-30**	**0**	**-5**	**0**	**20**	**30**
	20/18	TS	TS	**63**	**123**	**91**	**153**	**143**	**169**	**5**	**0**	**10**	**-25**	**-30**	**-10**	**-5**	**-10**	**25**	**35**
	21/00	TS	TS	**78**	**68**	**24**	**221**	**254**	**296**	**5**	**5**	**15**	**-25**	**-35**	**-10**	**-10**	**-10**	**25**	**40**
	21/06	STS	STS	**92**	**56**	**68**	**181**	**215**	**250**	**0**	**-5**	**15**	**-25**	**-38**	**-5**	**0**	**-5**	**25**	**45**
	21/12	STS	STS	**94**	**35**	**103**	**151**	**178**	**242**	**-5**	**-10**	**-15**	**-30**	**-5**	**0**	**5**	**20**	**25**	**10**
	21/18	STS	STS	**69**	**15**	**137**	**91**	**70**		**-5**	**0**	**-25**	**-20**		**0**	**0**	**25**	**20**	
	22/00	TY	TY	**39**	**31**	**88**	**69**	**37**		**0**	**5**	**-20**	**-10**		**-5**	**0**	**20**	**15**	
	22/06	TY	TY	**15**	**22**	**69**	**60**	**24**		**-5**	**15**	**-10**	**-3**		**0**	**-5**	**15**	**10**	
	22/12	TY	TY	**15**	**64**	**129**	**30**	**56**		**-10**	**-20**	**-5**	**0**		**5**	**25**	**10**	**5**	
	22/18	TY	TY	**11**	**73**	**10**	**40**			**0**	**-30**	**0**			**0**	**30**	**10**		
	23/00	TY	TY	**11**	**33**	**45**	**41**			**-5**	**-5**	**0**			**5**	**10**	**10**		
	23/06	TY	TY	**0**	**11**	**35**	**60**			**5**	**5**	**2**			**0**	**0**	**10**		
	23/12	TY	TY	**0**	**80**	**52**	**118**			**-10**	**0**	**4**			**20**	**5**	**5**		
	23/18	TY	TY	**10**	**32**	**87**				**-5**	**5**				**15**	**5**			
	24/00	TY	TY	**24**	**33**	**108**				**-5**	**0**				**10**	**10**			
	24/06	TY	TY	**0**	**98**	**45**				**-5**	**2**				**10**	**10**			
	24/12	TY	TY	**11**	**56**	**107**				**5**	**4**				**0**	**0**			
	24/18	STS	TY	**11**	**90**					**5**					**5**				
	25/00	STS	TY	**24**	**94**					**5**					**5**				
	25/06	STS	STS	**35**	**41**					**2**					**5**				
	25/12	STS	STS	**15**	**10**					**-5**					**10**				
	25/18	TS	STS	**30**															
	26/00	TS	TS	**59**															
	26/06	TS	TS	**45**															
	26/12	TS	TS	**59**															
Initial: TS/STS/TY			**mean**	**40**	**69**	**79**	**108**	**178**	**307**	**-1**	**0**	**-1**	**-8**	**-24**	**2**	**2**	**4**	**12**	**29**
Valid: TS/STS/TY			**sample**	**27**	**23**	**19**	**15**	**11**	**7**	**23**	**19**	**15**	**11**	**7**	**23**	**19**	**15**	**11**	**7**
Initial: TD(before upg.)			*mean*	*85*	*227*	*166*	*110*	*201*	*371*	*0*	*4*	*8*	*13*	*-10*	*-5*	*-10*	*-13*	*-10*	*18*
Valid: TD/TS/STS/TY			*sample*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Prapiroon(2404)																			
Jul.	20/00	TD	TD	*142*	*130*	*61*	*93*			*0*	*8*	*12*			*0*	*-15*	*-15*		
	20/06	TD	TD	*126*	*119*	*137*	*161*			*-4*	*7*	*4*			*0*	*-20*	*-5*		
	20/12	TD	TD	*44*	*113*	*119*				*0*	*15*				*-5*	*-25*			
	20/18	TD	TD	*0*	*67*	*96*				*4*	*15*				*-10*	*-25*			
	21/00	TS	TD	**0**	**64**	**76**				**6**	**10**				**-15**	**-15**			
	21/06	TS	TS	**0**	**90**	**104**				**13**	**8**				**-20**	**-5**			
	21/12	TS	TS	**0**	**80**					**9**					**-20**				
	21/18	TS	TS	**25**	**43**					**7**					**-15**				
	22/00	STS	STS	**15**	**66**					**0**					**0**				
	22/06	STS	STS	**15**	**0**					**2**					**0**				
	22/12	STS	STS	**11**															
	22/18	STS	STS	**39**															
	23/00	TS	TS	**35**															
	23/06	TS	TS	**31**															
Initial: TS/STS/TY			**mean**	**17**	**57**	**90**	**--**	**--**	**--**	**6**	**9**	**--**	**--**	**--**	**-12**	**-10**	**--**	**--**	**--**
Valid: TS/STS/TY			**sample**	**10**	**6**	**2**	**0**	**0**	**0**	**6**	**2**	**0**	**0**	**0**	**6**	**2**	**0**	**0**	**0**
Initial: TD(before upg.)			*mean*	*78*	*107*	*103*	*127*	*--*	*--*	*0*	*11*	*8*	*--*	*--*	*-4*	*-21*	*-10*	*--*	*--*
Valid: TD/TS/STS/TY			*sample*	*4*	*4*	*4*	*2*	*0*	*0*	*4*	*4*	*2*	*0*	*0*	*4*	*4*	*2*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Maria(2405)																			
Aug.	06/12	TD	TD	*20*	*80*	*117*	*29*	*77*	*398*	*-2*	*11*	*16*	*14*	*10*	*5*	*-15*	*-20*	*-10*	*-5*
	06/18	TD	TD	*11*	*124*	*111*	*123*	*375*	*995*	*0*	*14*	*10*	*10*	*14*	*0*	*-15*	*-10*	*-5*	*-10*
	07/00	TD	TD	*24*	*134*	*131*	*178*	*341*	*699*	*2*	*14*	*5*	*10*	*2*	*-5*	*-15*	*0*	*-5*	*-5*
	07/06	TD	TD	*46*	*122*	*78*	*244*	*549*	*1062*	*4*	*10*	*0*	*5*	*0*	*-10*	*-15*	*0*	*-5*	*5*
	07/12	TD	TD	*0*	*115*	*78*	*268*	*655*	*1191*	*9*	*10*	*5*	*5*	*-4*	*-15*	*-15*	*-5*	*-5*	*5*
	07/18	TS	TS	**10**	**82**	**56**	**133**	**343**		**10**	**10**	**5**	**5**		**-15**	**-15**	**-5**	**-5**	
	08/00	TS	TS	**15**	**44**	**44**	**111**	**300**		**5**	**-5**	**0**	**-7**		**-10**	**5**	**0**	**0**	
	08/06	TS	STS	**11**	**45**	**100**	**184**			**0**	**-10**	**-5**			**0**	**15**	**10**		
	08/12	STS	STS	**30**	**0**	**91**	**164**			**-5**	**-5**	**0**			**5**	**10**	**5**		
	08/18	STS	STS	**0**	**18**	**46**	**17**			**-5**	**-10**	**0**			**5**	**15**	**5**		
	09/00	STS	STS	**0**	**56**	**14**	**38**			**-15**	**-5**	**-12**			**20**	**10**	**10**		
	09/06	STS	STS	**11**	**42**	**62**				**-15**	**-5**				**20**	**10**			
	09/12	STS	STS	**11**	**43**	**55**				**-10**	**0**				**15**	**5**			
	09/18	STS	STS	**11**	**35**	**62**				**-5**	**0**				**10**	**5**			
	10/00	TS	STS	**0**	**58**	**34**				**0**	**-7**				**5**	**5**			
	10/06	TS	STS	**0**	**62**					**0**					**5**				
	10/12	STS	STS	**14**	**52**					**0**					**5**				
	10/18	STS	STS	**18**	**14**					**-5**					**5**				
	11/00	STS	STS	**9**	**17**					**-12**					**5**				
	11/06	STS	STS	**11**															
	11/12	STS	STS	**22**															
	11/18	STS	STS	**0**															
	12/00	TS	STS	**0**															
Initial: TS/STS/TY			**mean**	**10**	**41**	**57**	**108**	**322**	**--**	**-4**	**-4**	**-2**	**-1**	**--**	**5**	**7**	**4**	**-3**	**--**
Valid: TS/STS/TY			**sample**	**18**	**14**	**10**	**6**	**2**	**0**	**14**	**10**	**6**	**2**	**0**	**14**	**10**	**6**	**2**	**0**
Initial: TD(before upg.)			*mean*	*20*	*115*	*103*	*168*	*400*	*869*	*3*	*12*	*7*	*9*	*4*	*-5*	*-15*	*-7*	*-6*	*-2*
Valid: TD/TS/STS/TY			*sample*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Son-tinh(2406)																			
Aug.	10/12	TD	TD	*83*	*91*	*145*				*4*	*10*				*-5*	*-5*			
	10/18	TD	TD	*82*	*91*	*90*				*2*	*10*				*0*	*-5*			
	11/00	TS	TD	**0**	**62**	**112**				**0**	**8**				**0**	**-5**			
	11/06	TS	TD	**39**	**44**	**110**				**-2**	**6**				**0**	**-5**			
	11/12	TS	TS	**44**	**83**					**-4**					**0**				
	11/18	TS	TS	**0**	**9**					**-4**					**0**				
	12/00	TS	TS	**61**	**45**					**-2**					**0**				
	12/06	TS	TS	**0**	**11**					**4**					**-5**				
	12/12	TS	TS	**0**															
	12/18	TS	TS	**18**															
	13/00	TS	TS	**0**															
	13/06	TS	TS	**0**															
Initial: TS/STS/TY			**mean**	**16**	**43**	**111**	**--**	**--**	**--**	**-1**	**7**	**--**	**--**	**--**	**-1**	**-5**	**--**	**--**	**--**
Valid: TS/STS/TY			**sample**	**10**	**6**	**2**	**0**	**0**	**0**	**6**	**2**	**0**	**0**	**0**	**6**	**2**	**0**	**0**	**0**
Initial: TD(before upg.)			*mean*	*82*	*91*	*117*	*--*	*--*	*--*	*3*	*10*	*--*	*--*	*--*	*-3*	*-5*	*--*	*--*	*--*
Valid: TD/TS/STS/TY			*sample*	*2*	*2*	*2*	*0*	*0*	*0*	*2*	*2*	*0*	*0*	*0*	*2*	*2*	*0*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Ampil(2407)																			
Aug.	12/00	TD	TD	*11*	*75*	*59*	*51*	*22*	*201*	*4*	*17*	*20*	*35*	*35*	*-5*	*-15*	*-15*	*-30*	*-30*
	12/06	TD	TD	*10*	*94*	*92*	*57*	*67*	*236*	*6*	*10*	*10*	*20*	*20*	*-10*	*-10*	*-10*	*-20*	*-10*
	12/12	TS	TD	**22**	**67**	**99**	**88**	**120**	**316**	**9**	**10**	**25**	**20**	**15**	**-15**	**-10**	**-25**	**-20**	**-5**
	12/18	TS	TS	**33**	**78**	**76**	**67**	**154**	**281**	**15**	**0**	**15**	**20**	**15**	**-15**	**0**	**-15**	**-20**	**-5**
	13/00	TS	TS	**53**	**110**	**80**	**78**	**181**	**233**	**10**	**0**	**10**	**25**	**15**	**-10**	**0**	**-10**	**-25**	**-5**
	13/06	TS	STS	**11**	**162**	**109**	**106**	**186**	**88**	**5**	**5**	**5**	**20**	**15**	**0**	**0**	**-5**	**-10**	**-5**
	13/12	STS	STS	**0**	**99**	**58**	**109**	**224**	**125**	**-5**	**0**	**0**	**15**	**15**	**5**	**-5**	**-5**	**-5**	**-5**
	13/18	STS	STS	**0**	**108**	**78**	**134**	**166**	**78**	**-10**	**0**	**0**	**15**	**9**	**10**	**-5**	**-5**	**-5**	**-5**
	14/00	STS	STS	**10**	**71**	**51**	**114**	**79**		**-10**	**0**	**10**	**10**		**10**	**-5**	**-10**	**0**	
	14/06	STS	STS	**24**	**29**	**67**	**99**	**55**		**-5**	**0**	**15**	**5**		**5**	**-5**	**-5**	**0**	
	14/12	STS	STS	**0**	**38**	**78**	**180**	**149**		**0**	**0**	**15**	**5**		**-5**	**-5**	**-5**	**0**	
	14/18	STS	STS	**0**	**22**	**85**	**82**	**261**		**0**	**0**	**10**	**10**		**-5**	**-5**	**0**	**-5**	
	15/00	TY	TY	**15**	**14**	**92**	**185**			**0**	**10**	**10**			**-5**	**-10**	**0**		
	15/06	TY	TY	**11**	**38**	**124**	**210**			**-5**	**10**	**10**			**0**	**0**	**0**		
	15/12	TY	TY	**15**	**64**	**188**	**181**			**-10**	**5**	**5**			**5**	**5**	**5**		
	15/18	TY	TY	**0**	**71**	**93**	**176**			**0**	**0**	**5**			**0**	**10**	**5**		
	16/00	TY	TY	**0**	**63**	**69**				**5**	**0**				**-5**	**10**			
	16/06	TY	TY	**0**	**57**	**44**				**0**	**0**				**10**	**10**			
	16/12	TY	TY	**9**	**118**	**139**				**-5**	**0**				**15**	**10**			
	16/18	TY	TY	**29**	**48**	**190**				**0**	**-5**				**10**	**5**			
	17/00	TY	TY	**14**	**53**					**0**					**5**				
	17/06	TY	TY	**72**	**48**					**0**					**5**				
	17/12	TY	TY	**86**	**92**					**-5**					**10**				
	17/18	STS	TY	**71**	**74**					**-5**					**10**				
	18/00	STS	TY	**44**															
	18/06	STS	TY	**14**															
	18/12	STS	STS	**8**															
	18/18	STS	STS	**34**															
Initial: TS/STS/TY			**mean**	**22**	**69**	**96**	**129**	**158**	**187**	**-1**	**2**	**10**	**15**	**14**	**2**	**0**	**-5**	**-9**	**-5**
Valid: TS/STS/TY			**sample**	**26**	**22**	**18**	**14**	**10**	**6**	**22**	**18**	**14**	**10**	**6**	**22**	**18**	**14**	**10**	**6**
Initial: TD(before upg.)			*mean*	*11*	*85*	*76*	*54*	*44*	*219*	*5*	*14*	*15*	*28*	*28*	*-8*	*-13*	*-13*	*-25*	*-20*
Valid: TD/TS/STS/TY			*sample*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time (UTC)		Grade Best	Grade Prov.	Center Position (km) T=0‡	=24	=48	=72	=96	=120	Central Pressure (hPa) T=24	=48	=72	=96	=120	Max. Wind Speed (kt)† T=24	=48	=72	=96	=120
									Wukong(2408)										
Aug.	13/00	TS	TD	**45**	**152**					**0**					**0**				
	13/06	TS	TS	**24**	**124**					**0**					**0**				
	13/12	TS	TS	**24**															
	13/18	TS	TS	**78**															
	14/00	TS	TS	**30**															
	14/06	TS	TS	**95**															
Initial: TS/STS/TY			**mean**	**49**	**138**	--	--	--	--	**0**	--	--	--	--	**0**	--	--	--	--
Valid: TS/STS/TY			**sample**	**6**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**
Initial: TD(before upg.)			*mean*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Valid: TD/TS/STS/TY			*sample*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time (UTC)		Grade Best	Grade Prov.	Center Position (km) T=0‡	=24	=48	=72	=96	=120	Central Pressure (hPa) T=24	=48	=72	=96	=120	Max. Wind Speed (kt)† T=24	=48	=72	=96	=120
									Jongdari(2409)										
Aug.	18/18	TS	TS	**92**	**31**	**82**				**4**	**-4**				**-5**	**0**			
	19/00	TS	TS	**24**	**31**					**2**					**-5**				
	19/06	TS	TS	**0**	**24**					**0**					**5**				
	19/12	TS	TS	**20**	**68**					**-4**					**5**				
	19/18	TS	TS	**0**	**35**					**-6**					**5**				
	20/00	TS	TS	**0**															
	20/06	TS	TS	**15**															
	20/12	TS	TD	**0**															
Initial: TS/STS/TY			**mean**	**19**	**38**	**82**	--	--	--	**-1**	**-4**	--	--	--	**1**	**0**	--	--	--
Valid: TS/STS/TY			**sample**	**8**	**5**	**1**	**0**	**0**	**0**	**5**	**1**	**0**	**0**	**0**	**5**	**1**	**0**	**0**	**0**
Initial: TD(before upg.)			*mean*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Valid: TD/TS/STS/TY			*sample*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time (UTC)		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
		Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Shanshan(2410)																			
Aug.	21/00	TD	TD	*15*	*65*	*24*	*33*	*166*	*478*	*2*	*9*	*5*	*5*	*5*	*-5*	*-15*	*-10*	*-10*	*-10*
	21/06	TD	TD	*11*	*64*	*25*	*81*	*265*	*623*	*4*	*9*	*5*	*5*	*0*	*-10*	*-15*	*-10*	*-10*	*-5*
	21/12	TD	TD	*21*	*102*	*35*	*68*	*349*	*623*	*12*	*9*	*5*	*5*	*0*	*-20*	*-15*	*-10*	*-10*	*-5*
	21/18	TS	TS	**15**	**109**	**74**	**59**	**387**	**627**	**15**	**7**	**5**	**0**	**5**	**-20**	**-10**	**-10**	**-5**	**-10**
	22/00	TS	TS	**15**	**91**	**95**	**88**	**311**	**636**	**11**	**5**	**0**	**-5**	**20**	**-10**	**-5**	**-5**	**0**	**-15**
	22/06	TS	TS	**21**	**86**	**109**	**83**	**374**	**807**	**5**	**5**	**0**	**-15**	**15**	**-5**	**-5**	**0**	**10**	**-10**
	22/12	STS	STS	**32**	**101**	**118**	**96**	**324**	**834**	**0**	**-5**	**-10**	**-30**	**10**	**0**	**0**	**5**	**15**	**-10**
	22/18	STS	STS	**11**	**88**	**76**	**119**	**373**	**937**	**-10**	**-15**	**-30**	**-20**	**25**	**10**	**10**	**15**	**5**	**-20**
	23/00	STS	STS	**11**	**54**	**59**	**155**	**396**	**1065**	**-5**	**-15**	**-30**	**0**	**40**	**5**	**10**	**15**	**-5**	**-35**
	23/06	STS	STS	**0**	**11**	**75**	**265**	**558**	**1160**	**-5**	**-25**	**-30**	**5**	**40**	**5**	**15**	**20**	**-5**	**-35**
	23/12	STS	STS	**11**	**80**	**132**	**318**	**635**	**1204**	**0**	**-15**	**-30**	**15**	**40**	**0**	**10**	**20**	**-10**	**-30**
	23/18	STS	STS	**0**	**11**	**172**	**308**	**794**	**1568**	**-5**	**-15**	**-20**	**20**	**40**	**0**	**10**	**10**	**-15**	**-35**
	24/00	TY	TY	**0**	**72**	**190**	**329**	**772**	**1378**	**-10**	**-15**	**0**	**20**	**30**	**5**	**10**	**0**	**-15**	**-30**
	24/06	TY	TY	**0**	**131**	**229**	**420**	**1103**	**1878**	**-10**	**-25**	**0**	**40**	**4**	**5**	**15**	**0**	**-35**	**-10**
	24/12	TY	TY	**10**	**159**	**235**	**493**	**1177**	**1774**	**-10**	**-30**	**15**	**40**	**0**	**5**	**20**	**-10**	**-30**	**-5**
	24/18	TY	TY	**10**	**159**	**214**	**474**	**1101**	**1795**	**-15**	**-20**	**20**	**30**	**-2**	**10**	**10**	**-15**	**-25**	**0**
	25/00	TY	TY	**0**	**113**	**184**	**480**	**883**	**1644**	**-15**	**0**	**20**	**15**	**-4**	**10**	**0**	**-15**	**-15**	**5**
	25/06	TY	TY	**30**	**89**	**165**	**362**	**639**	**1102**	**-15**	**0**	**15**	**-5**	**-4**	**10**	**0**	**-15**	**5**	**5**
	25/12	TY	TY	**24**	**52**	**127**	**330**	**531**		**-15**	**10**	**15**	**-15**		**10**	**-5**	**-10**	**15**	
	25/18	TY	TY	**0**	**37**	**39**	**108**	**411**		**-5**	**15**	**5**	**-12**		**0**	**-10**	**-5**	**15**	
	26/00	TY	TY	**10**	**30**	**24**	**66**	**269**		**15**	**15**	**0**	**-19**		**-10**	**-10**	**0**	**25**	
	26/06	TY	TY	**10**	**11**	**74**	**115**	**46**		**5**	**15**	**-20**	**-19**		**-5**	**-10**	**20**	**25**	
	26/12	TY	TY	**0**	**31**	**109**	**87**			**15**	**15**	**-30**			**-10**	**-5**	**30**		
	26/18	TY	TY	**0**	**24**	**91**	**56**			**25**	**5**	**-32**			**-15**	**0**	**35**		
	27/00	TY	TY	**0**	**15**	**104**	**11**			**0**	**-20**	**-34**			**0**	**15**	**40**		
	27/06	TY	TY	**0**	**51**	**125**	**72**			**0**	**-25**	**-14**			**0**	**25**	**20**		
	27/12	TY	TY	**0**	**59**	**62**				**0**	**-25**				**5**	**30**			
	27/18	TY	TY	**0**	**58**	**108**				**-20**	**-27**				**15**	**35**			
	28/00	TY	TY	**10**	**94**	**121**				**-35**	**-24**				**25**	**35**			
	28/06	TY	TY	**0**	**44**	**51**				**-25**	**-19**				**25**	**30**			
	28/12	TY	TY	**0**	**29**					**-40**					**30**				
	28/18	TY	TY	**10**	**15**					**-22**					**20**				
	29/00	TY	TY	**11**	**0**					**-14**					**15**				
	29/06	STS	STS	**11**	**51**					**-9**					**10**				
	29/12	TS	STS	**0**															
	29/18	TS	TS	**0**															
	30/00	TS	TS	**11**															
	30/06	TS	TS	**0**															
Initial: TS/STS/TY			**mean**	**8**	**63**	**117**	**213**	**583**	**1227**	**-6**	**-8**	**-8**	**2**	**17**	**5**	**8**	**6**	**-2**	**-16**
Valid: TS/STS/TY			**sample**	**35**	**31**	**27**	**23**	**19**	**15**	**31**	**27**	**23**	**19**	**15**	**31**	**27**	**23**	**19**	**15**
Initial: TD(before upg.)			*mean*	*16*	*77*	*28*	*61*	*260*	*575*	*6*	*9*	*5*	*5*	*2*	*-12*	*-15*	*-10*	*-10*	*-7*
Valid: TD/TS/STS/TY			*sample*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Yagi(2411)											
Sep.	01/00	TD	TD	*0*	*177*	*476*	*652*	*771*	*1071*	*4*	*2*	*26*	*77*	*75*	*-10*	*-5*	*-30*	*-60*	*-55*
	01/06	TS	TD	**49**	**150**	**446**	**424**	**578**	**807**	**4**	**6**	**41**	**70**	**60**	**-10**	**-10**	**-45**	**-55**	**-45**
	01/12	TS	TS	**49**	**166**	**317**	**337**	**535**	**754**	**0**	**6**	**50**	**65**	**40**	**0**	**-10**	**-45**	**-50**	**-30**
	01/18	TS	TS	**0**	**127**	**197**	**151**	**256**	**397**	**-4**	**12**	**60**	**60**	**20**	**5**	**-15**	**-50**	**-45**	**-15**
	02/00	TS	TS	**22**	**245**	**217**	**116**	**231**	**386**	**-4**	**20**	**60**	**50**	**20**	**5**	**-20**	**-45**	**-35**	**-10**
	02/06	TS	TS	**11**	**152**	**39**	**79**	**153**	**280**	**0**	**25**	**50**	**35**	**25**	**0**	**-20**	**-35**	**-25**	**-15**
	02/12	TS	TS	**0**	**33**	**49**	**101**	**114**	**230**	**0**	**35**	**45**	**15**	**-20**	**-5**	**-30**	**-30**	**-10**	**20**
	02/18	TS	TS	**0**	**44**	**39**	**81**	**168**	**183**	**10**	**50**	**40**	**0**	**-17**	**-10**	**-35**	**-25**	**0**	**20**
	03/00	TS	TS	**0**	**62**	**33**	**54**	**135**	**161**	**20**	**55**	**35**	**5**	**-6**	**-20**	**-35**	**-20**	**0**	**5**
	03/06	TS	STS	**42**	**25**	**59**	**110**	**208**	**115**	**25**	**40**	**20**	**35**	**-2**	**-20**	**-25**	**-10**	**-25**	**0**
	03/12	STS	STS	**67**	**35**	**62**	**115**	**169**		**35**	**35**	**5**	**-10**		**-25**	**-20**	**0**	**10**	
	03/18	STS	STS	**42**	**11**	**31**	**21**	**49**		**45**	**35**	**-10**	**-12**		**-30**	**-20**	**10**	**15**	
	04/00	TY	TY	**0**	**31**	**74**	**33**	**254**		**50**	**20**	**25**	**2**		**-30**	**-10**	**-15**	**-5**	
	04/06	TY	TY	**0**	**22**	**57**	**15**	**313**		**35**	**10**	**30**	**2**		**-20**	**-5**	**-20**	**-5**	
	04/12	TY	TY	**0**	**15**	**54**	**74**			**10**	**-5**	**5**			**-5**	**5**	**5**		
	04/18	TY	TY	**11**	**71**	**104**	**122**			**0**	**0**	**-12**			**0**	**0**	**0**		
	05/00	TY	TY	**0**	**92**	**84**	**186**			**-10**	**25**	**0**			**5**	**-15**	**-5**		
	05/06	TY	TY	**0**	**47**	**76**	**198**			**-10**	**30**	**2**			**5**	**-20**	**-5**		
	05/12	TY	TY	**0**	**62**	**114**				**-25**	**-5**				**15**	**5**			
	05/18	TY	TY	**0**	**64**	**112**				**-5**	**2**				**5**	**0**			
	06/00	TY	TY	**0**	**66**	**118**				**0**	**-2**				**-5**	**-5**			
	06/06	TY	TY	**0**	**52**	**59**				**20**	**0**				**-20**	**-5**			
	06/12	TY	TY	**0**	**77**					**-10**					**5**				
	06/18	TY	TY	**0**	**74**					**-2**					**0**				
	07/00	TY	TY	**0**	**59**					**0**					**-5**				
	07/06	TY	TY	**0**	**11**					**0**					**-5**				
	07/12	STS	TY	**11**															
	07/18	TS	STS	**0**															
	08/00	TS	TS	**46**															
	08/06	TS	TD	**35**															
Initial: TS/STS/TY			**mean**	**13**	**72**	**111**	**130**	**243**	**368**	**7**	**19**	**26**	**24**	**13**	**-7**	**-14**	**-20**	**-18**	**-8**
Valid: TS/STS/TY			**sample**	**29**	**25**	**21**	**17**	**13**	**9**	**25**	**21**	**17**	**13**	**9**	**25**	**21**	**17**	**13**	**9**
Initial: TD(before upg.)			*mean*	*0*	*177*	*476*	*652*	*771*	*1071*	*4*	*2*	*26*	*77*	*75*	*-10*	*-5*	*-30*	*-60*	*-55*
Valid: TD/TS/STS/TY			*sample*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Leepi(2412)											
Sep.	05/06	TS	TS	**11**	**105**					**2**					**-5**				
	05/12	TS	TS	**9**															
	05/18	TS	TS	**18**															
	06/00	TS	TS	**0**															
	06/06	TS	TS	**29**															
Initial: TS/STS/TY			**mean**	**14**	**105**	**--**	**--**	**--**	**--**	**2**	**--**	**--**	**--**	**--**	**-5**	**--**	**--**	**--**	**--**
Valid: TS/STS/TY			**sample**	**5**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Initial: TD(before upg.)			*mean*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*
Valid: TD/TS/STS/TY			*sample*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Bebinca(2413)																			
Sep.	09/18	TD	TD	*0*	*219*	*100*	*46*	*100*	*391*	*0*	*-2*	*2*	*5*	*20*	*0*	*0*	*0*	*-5*	*-20*
	10/00	TD	TD	*0*	*35*	*74*	*46*	*212*	*340*	*2*	*0*	*-9*	*0*	*20*	*-5*	*0*	*10*	*0*	*-25*
	10/06	TD	TD	*16*	*74*	*54*	*39*	*170*	*299*	*2*	*0*	*-5*	*5*	*20*	*-5*	*0*	*5*	*-5*	*-25*
	10/12	TS	TS	**56**	**101**	**74**	**46**	**180**	**153**	**0**	**0**	**-5**	**5**	**15**	**0**	**0**	**5**	**-5**	**-20**
	10/18	TS	TS	**57**	**48**	**71**	**15**	**112**	**63**	**-4**	**-7**	**-5**	**5**	**5**	**5**	**10**	**5**	**-5**	**-10**
	11/00	TS	STS	**33**	**101**	**61**	**15**	**88**	**70**	**-7**	**-19**	**-20**	**0**	**-5**	**10**	**20**	**20**	**-5**	**-5**
	11/06	TS	STS	**24**	**116**	**61**	**122**	**107**	**109**	**-7**	**-15**	**-15**	**0**	**-5**	**10**	**15**	**15**	**-5**	**-5**
	11/12	TS	STS	**11**	**133**	**143**	**134**	**169**	**115**	**-7**	**-15**	**-10**	**0**	**2**	**10**	**15**	**10**	**-5**	**-10**
	11/18	TS	STS	**56**	**63**	**82**	**164**	**197**	**87**	**-12**	**-15**	**-5**	**5**	**4**	**20**	**15**	**5**	**-10**	**-5**
	12/00	TS	STS	**0**	**11**	**56**	**156**	**145**		**-14**	**-15**	**0**	**0**		**20**	**15**	**-5**	**-10**	
	12/06	TS	STS	**15**	**56**	**112**	**249**	**218**		**-10**	**-15**	**0**	**5**		**15**	**15**	**-5**	**-15**	
	12/12	TS	STS	**0**	**92**	**74**	**211**	**181**		**-10**	**-10**	**-5**	**8**		**15**	**10**	**0**	**-20**	
	12/18	TS	STS	**25**	**70**	**119**	**144**	**35**		**-5**	**-5**	**5**	**0**		**5**	**5**	**-10**	**-5**	
	13/00	TS	TS	**0**	**89**	**121**	**65**			**0**	**5**	**-5**			**0**	**-10**	**-5**		
	13/06	TS	TS	**0**	**89**	**145**	**114**			**0**	**5**	**7**			**0**	**-10**	**-25**		
	13/12	TS	TS	**33**	**99**	**136**	**133**			**0**	**5**	**2**			**0**	**-10**	**-15**		
	13/18	STS	TS	**0**	**88**	**160**	**179**			**5**	**0**	**8**			**-5**	**-5**	**-5**		
	14/00	STS	STS	**0**	**89**	**172**				**5**	**0**				**-10**	**-10**			
	14/06	STS	STS	**0**	**58**	**70**				**5**	**9**				**-10**	**-20**			
	14/12	STS	STS	**0**	**97**	**119**				**5**	**12**				**-10**	**-20**			
	14/18	TY	TY	**0**	**71**	**114**				**-5**	**4**				**0**	**-5**			
	15/00	TY	TY	**24**	**44**					**-15**					**10**				
	15/06	TY	TY	**0**	**36**					**-5**					**0**				
	15/12	TY	TY	**29**	**36**					**0**					**-5**				
	15/18	TY	TY	**31**	**35**					**-2**					**0**				
	16/00	TY	TY	**0**															
	16/06	STS	STS	**0**															
	16/12	STS	STS	**0**															
	16/18	TS	TS	**15**															
Initial: TS/STS/TY			**mean**	**16**	**74**	**105**	**125**	**143**	**99**	**-4**	**-4**	**-3**	**3**	**3**	**4**	**2**	**-1**	**-9**	**-9**
Valid: TS/STS/TY			**sample**	**26**	**22**	**18**	**14**	**10**	**6**	**22**	**18**	**14**	**10**	**6**	**22**	**18**	**14**	**10**	**6**
Initial: TD(before upg.)			*mean*	*5*	*109*	*76*	*43*	*161*	*343*	*1*	*-1*	*-4*	*3*	*20*	*-3*	*0*	*5*	*-3*	*-23*
Valid: TD/TS/STS/TY			*sample*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Pulasan(2414)																			
Sep.	15/06	TD	TD	*55*	*214*	*101*	*224*	*190*	*686*	*0*	*4*	*4*	*-2*	*-2*	*0*	*-5*	*-5*	*0*	*-5*
	15/12	TS	TS	**89**	**208**	**197**	**150**	**334**	**599**	**0**	**0**	**0**	**-4**	**-2**	**0**	**0**	**0**	**5**	**-5**
	15/18	TS	TS	**107**	**94**	**123**	**257**	**329**	**680**	**0**	**0**	**-2**	**-4**	**0**	**0**	**0**	**0**	**5**	**-10**
	16/00	TS	TS	**74**	**105**	**226**	**273**	**365**		**4**	**0**	**-2**	**-2**		**-5**	**0**	**0**	**-5**	
	16/06	TS	TS	**135**	**91**	**180**	**263**			**0**	**4**	**0**			**0**	**-5**	**-10**		
	16/12	TS	TS	**156**	**99**	**207**	**291**			**0**	**0**	**-2**			**0**	**0**	**-5**		
	16/18	TS	TS	**101**	**70**	**257**	**342**			**0**	**-2**	**0**			**0**	**0**	**-5**		
	17/00	TS	TS	**181**	**195**	**230**	**370**			**4**	**0**	**0**			**-5**	**-5**	**-5**		
	17/06	TS	TS	**54**	**194**	**271**	**267**			**4**	**0**	**0**			**-5**	**-5**	**-5**		
	17/12	TS	TS	**15**	**142**	**193**	**426**			**0**	**-2**	**2**			**0**	**0**	**-5**		
	17/18	TS	TS	**47**	**178**	**211**				**0**	**0**				**-5**	**-5**			
	18/00	TS	TS	**102**	**206**	**166**				**0**	**2**				**-5**	**-5**			
	18/06	TS	TS	**54**	**178**	**140**				**0**	**2**				**-5**	**-5**			
	18/12	TS	TS	**39**	**111**	**210**				**-2**	**2**				**0**	**-5**			
	18/18	TS	TS	**56**	**88**					**2**					**-5**				
	19/00	TS	TS	**0**	**49**					**2**					**-5**				
	19/06	TS	TS	**139**	**123**					**2**					**-5**				
	19/12	TS	TS	**65**	**133**					**-2**					**0**				
	19/18	TS	TS	**22**	**65**					**0**					**-5**				
	20/00	TS	TS	**0**	**78**					**-2**					**0**				
	20/06	TS	TS	**11**															
	20/12	TS	TS	**0**															
	20/18	TS	TS	**0**															
	21/00	TS	TS	**0**															
Initial: TS/STS/TY			**mean**	**63**	**127**	**201**	**293**	**343**	**639**	**1**	**0**	**0**	**-3**	**-1**	**-3**	**-3**	**-4**	**2**	**-8**
Valid: TS/STS/TY			**sample**	**23**	**19**	**13**	**9**	**3**	**2**	**19**	**13**	**9**	**3**	**2**	**19**	**13**	**9**	**3**	**2**
Initial: TD(before upg.)			*mean*	*55*	*214*	*101*	*224*	*190*	*686*	*0*	*4*	*4*	*-2*	*-2*	*0*	*-5*	*-5*	*0*	*-5*
Valid: TD/TS/STS/TY			*sample*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Soulik(2415)																			
Sep.	16/00	TD	TD	*65*	*104*	*178*	*534*	*713*		*-2*	*0*	*2*	*-4*		*5*	*5*	*5*	*10*	
	16/06	TD	TD	*46*	*176*	*119*	*415*	*493*		*-2*	*-2*	*-2*	*-10*		*5*	*5*	*5*	*10*	
	16/12	TD	TD	*33*	*187*	*177*	*373*	*610*		*-2*	*-2*	*-6*	*-8*		*5*	*5*	*10*	*5*	
	16/18	TD	TD	*0*	*259*	*162*	*318*			*-2*	*2*	*-8*			*5*	*0*	*10*		
	17/00	TD	TD	*0*	*177*	*249*	*274*			*-2*	*-2*	*-8*			*5*	*5*	*10*		
	17/06	TD	TD	*213*	*116*	*266*	*260*			*-2*	*-2*	*-6*			*5*	*5*	*5*		
	17/12	TD	TD	*301*	*119*	*149*	*297*			*-2*	*-6*	*-8*			*5*	*10*	*5*		
	17/18	TD	TD	*295*	*123*	*151*				*2*	*-8*				*0*	*10*			
	18/00	TD	TD	*221*	*140*	*109*				*2*	*-4*				*0*	*5*			
	18/06	TD	TD	*82*	*85*	*160*				*2*	*-6*				*0*	*5*			
	18/12	TD	TD	*63*	*88*	*233*				*-2*	*-8*				*5*	*5*			
	18/18	TS	TD	**53**															
	19/00	TS	TS	**0**															
	19/06	TS	TS	**0**															
Initial: TS/STS/TY			**mean**	**18**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Valid: TS/STS/TY			**sample**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial: TD(before upg.)			*mean*	*120*	*143*	*178*	*353*	*605*	*--*	*-1*	*-3*	*-5*	*-7*	*--*	*4*	*5*	*7*	*8*	*--*
Valid: TD/TS/STS/TY			*sample*	*11*	*11*	*11*	*7*	*3*	*0*	*11*	*11*	*7*	*3*	*0*	*11*	*11*	*7*	*3*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Cimaron(2416)											
Sep.	25/00	TS	TD	**20**	**51**					**4**					**0**				
	25/06	TS	TS	**0**															
	25/12	TS	TS	**0**															
	25/18	TS	TS	**22**															
	26/00	TS	TS	**10**															
Initial: TS/STS/TY			**mean**	**10**	**51**	**--**	**--**	**--**	**--**	**4**	**--**	**--**	**--**	**--**	**0**	**--**	**--**	**--**	**--**
Valid: TS/STS/TY			**sample**	**5**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Initial: TD(before upg.)			*mean*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*
Valid: TD/TS/STS/TY			*sample*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Jebi(2417)											
Sep.	26/06	TD	TD	*63*	*184*	*179*	*337*			*0*	*0*	*2*			*0*	*0*	*-5*		
	26/12	TD	TD	*39*	*192*	*272*	*362*			*0*	*0*	*2*			*0*	*0*	*-5*		
	26/18	TD	TD	*111*	*90*	*135*	*149*			*0*	*0*	*2*			*0*	*0*	*-5*		
	27/00	TS	TD	**81**	**38**	**167**	**91**	**79**	**191**	**0**	**0**	**0**	**18**	**11**	**0**	**0**	**0**	**-25**	**-25**
	27/06	TS	TS	**63**	**77**	**169**	**91**	**83**	**67**	**0**	**0**	**4**	**18**	**6**	**0**	**0**	**-5**	**-30**	**-15**
	27/12	TS	TS	**84**	**164**	**179**	**87**	**118**		**-2**	**-2**	**4**	**12**		**5**	**5**	**0**	**-15**	
	27/18	TS	TS	**101**	**136**	**161**	**65**	**141**		**-4**	**-6**	**-10**	**10**		**10**	**15**	**5**	**-15**	
	28/00	TS	TS	**79**	**191**	**131**	**72**	**238**		**-4**	**-8**	**5**	**7**		**10**	**10**	**-5**	**-10**	
	28/06	TS	TS	**38**	**97**	**60**	**11**	**146**		**-4**	**-4**	**5**	**4**		**10**	**10**	**-5**	**-5**	
	28/12	TS	TS	**101**	**60**	**19**	**99**			**-4**	**-2**	**5**			**10**	**5**	**-5**		
	28/18	TS	TS	**59**	**80**	**66**	**48**			**-4**	**-5**	**10**			**10**	**5**	**-10**		
	29/00	TS	TS	**122**	**15**	**60**	**112**			**-4**	**5**	**7**			**10**	**-5**	**-10**		
	29/06	TS	TS	**31**	**46**	**107**	**321**			**2**	**5**	**2**			**5**	**-5**	**0**		
	29/12	TS	TS	**42**	**10**	**102**				**4**	**5**				**0**	**-5**			
	29/18	TS	TS	**20**	**44**	**56**				**2**	**10**				**-5**	**-10**			
	30/00	TS	TS	**49**	**30**	**114**				**12**	**5**				**-15**	**-5**			
	30/06	TS	TS	**49**	**72**	**227**				**12**	**2**				**-15**	**0**			
	30/12	STS	TS	**11**	**163**					**12**					**-15**				
	30/18	STS	STS	**38**	**151**					**10**					**-10**				
Oct.	01/00	TY	STS	**9**	**154**					**-5**					**5**				
	01/06	TY	STS	**9**	**161**					**0**					**10**				
	01/12	TY	STS	**38**															
	01/18	TY	STS	**28**															
	02/00	STS	STS	**28**															
	02/06	STS	STS	**8**															
Initial: TS/STS/TY			**mean**	**49**	**94**	**116**	**100**	**134**	**129**	**1**	**0**	**3**	**12**	**9**	**1**	**1**	**-4**	**-17**	**-20**
Valid: TS/STS/TY			**sample**	**22**	**18**	**14**	**10**	**6**	**2**	**18**	**14**	**10**	**6**	**2**	**18**	**14**	**10**	**6**	**2**
Initial: TD(before upg.)			*mean*	*71*	*155*	*195*	*283*	*--*	*--*	*0*	*0*	*2*	*--*	*--*	*0*	*0*	*-5*	*--*	*--*
Valid: TD/TS/STS/TY			*sample*	*3*	*3*	*3*	*3*	*0*	*0*	*3*	*3*	*3*	*0*	*0*	*3*	*3*	*3*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Krathon(2418)											
Sep.	26/18	TD	TD	*0*	*137*	*107*	*230*	*551*	*689*	*0*	*11*	*42*	*55*	*45*	*5*	*-15*	*-40*	*-50*	*-35*
	27/00	TD	TD	*22*	*94*	*39*	*220*	*492*	*485*	*2*	*16*	*57*	*65*	*35*	*0*	*-20*	*-50*	*-50*	*-25*
	27/06	TD	TD	*39*	*74*	*24*	*153*	*320*	*582*	*4*	*26*	*55*	*55*	*25*	*-5*	*-30*	*-45*	*-40*	*-20*
	27/12	TD	TD	*15*	*49*	*109*	*230*	*332*	*496*	*8*	*20*	*40*	*50*	*25*	*-15*	*-20*	*-30*	*-35*	*-25*
	27/18	TD	TD	*0*	*46*	*114*	*260*	*333*	*522*	*15*	*35*	*35*	*30*	*0*	*-20*	*-30*	*-30*	*-25*	*-5*
	28/00	TS	TS	**32**	**39**	**117**	**286**	**342**	**577**	**12**	**35**	**35**	**25**	**-10**	**-10**	**-25**	**-25**	**-20**	**5**
	28/06	TS	TS	**34**	**22**	**137**	**233**	**277**	**535**	**15**	**30**	**35**	**15**	**-10**	**-15**	**-20**	**-25**	**-15**	**10**
	28/12	STS	TS	**11**	**86**	**167**	**210**	**314**		**15**	**30**	**30**	**15**		**-15**	**-20**	**-20**	**-15**	
	28/18	STS	STS	**21**	**53**	**94**	**188**	**331**		**25**	**20**	**30**	**-5**		**-20**	**-20**	**-20**	**0**	
	29/00	STS	STS	**35**	**33**	**115**	**193**	**392**		**35**	**35**	**30**	**-15**		**-25**	**-25**	**-20**	**10**	
	29/06	TY	TY	**21**	**94**	**122**	**219**	**506**		**20**	**30**	**15**	**-15**		**-15**	**-20**	**-15**	**15**	
	29/12	TY	TY	**21**	**96**	**89**	**266**			**20**	**15**	**15**			**-15**	**-10**	**-15**		
	29/18	TY	TY	**10**	**42**	**70**	**241**			**5**	**5**	**0**			**-10**	**-5**	**-5**		
	30/00	TY	TY	**15**	**33**	**53**	**258**			**5**	**-15**	**-5**			**-5**	**10**	**0**		
	30/06	TY	TY	**0**	**33**	**99**	**273**			**5**	**-15**	**-5**			**-5**	**10**	**5**		
	30/12	TY	TY	**0**	**31**	**137**				**0**	**-5**				**0**	**5**			
	30/18	TY	TY	**11**	**53**	**175**				**-10**	**-20**				**5**	**15**			
Oct.	01/00	TY	TY	**0**	**61**	**129**				**-15**	**-20**				**10**	**20**			
	01/06	TY	TY	**0**	**33**	**112**				**-15**	**-15**				**10**	**20**			
	01/12	TY	TY	**15**	**22**					**-20**					**15**				
	01/18	TY	TY	**11**	**64**					**-25**					**20**				
	02/00	TY	TY	**11**	**80**					**-20**					**20**				
	02/06	TY	TY	**11**	**46**					**-10**					**15**				
	02/12	TY	TY	**0**															
	02/18	TY	TY	**0**															
	03/00	STS	TY	**15**															
	03/06	STS	STS	**0**															
Initial: TS/STS/TY			**mean**	**12**	**51**	**116**	**237**	**360**	**556**	**2**	**8**	**18**	**3**	**-10**	**-2**	**-5**	**-14**	**-4**	**8**
Valid: TS/STS/TY			**sample**	**22**	**18**	**14**	**10**	**6**	**2**	**18**	**14**	**10**	**6**	**2**	**18**	**14**	**10**	**6**	**2**
Initial: TD(before upg.)			*mean*	*15*	*80*	*79*	*219*	*406*	*555*	*6*	*22*	*46*	*51*	*26*	*-7*	*-23*	*-39*	*-40*	*-22*
Valid: TD/TS/STS/TY			*sample*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Barijat(2419)											
Oct.	07/00	TS	TD	**0**	**35**	**146**	**64**			**0**	**0**	**0**			**0**	**0**	**0**		
	07/06	TS	TD	**0**	**44**	**73**	**191**			**2**	**2**	**2**			**0**	**0**	**0**		
	07/12	TS	TD	**61**	**94**	**56**	**146**			**-2**	**-4**	**0**			**0**	**5**	**5**		
	07/18	TS	TD	**46**	**150**	**128**	**225**			**-2**	**-2**	**5**			**0**	**5**	**0**		
	08/00	TS	TD	**0**	**132**	**101**				**-4**	**0**				**0**	**-5**			
	08/06	TS	TD	**0**	**99**	**195**				**-2**	**2**				**0**	**-5**			
	08/12	TS	TD	**10**	**189**	**98**				**-2**	**6**				**0**	**-5**			
	08/18	TS	TD	**0**	**125**	**334**				**0**	**9**				**0**	**-5**			
	09/00	TS	TD	**11**	**67**					**2**					**-5**				
	09/06	TS	TS	**0**	**58**					**2**					**0**				
	09/12	TS	TS	**0**	**106**					**6**					**0**				
	09/18	TS	TS	**15**	**164**					**5**					**0**				
	10/00	TS	TS	**11**															
	10/06	TS	TS	**11**															
	10/12	TS	TS	**22**															
	10/18	TS	TS	**38**															
Initial: TS/STS/TY			**mean**	**14**	**105**	**141**	**157**	**--**	**--**	**0**	**2**	**2**	**--**	**--**	**0**	**-1**	**1**	**--**	**--**
Valid: TS/STS/TY			**sample**	**16**	**12**	**8**	**4**	**0**	**0**	**12**	**8**	**4**	**0**	**0**	**12**	**8**	**4**	**0**	**0**
Initial: TD(before upg.)			*mean*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*	*--*
Valid: TD/TS/STS/TY			*sample*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Trami(2420)											
Oct.	20/06	TD	TD	*11*	*89*	*263*	*342*	*467*	*639*	*0*	*4*	*5*	*0*	*0*	*5*	*-5*	*-5*	*0*	*0*
	20/12	TD	TD	*0*	*253*	*270*	*330*	*427*	*672*	*0*	*4*	*5*	*0*	*0*	*5*	*-5*	*-5*	*0*	*0*
	20/18	TD	TD	*0*	*161*	*157*	*244*	*311*	*679*	*2*	*0*	*0*	*-5*	*-5*	*0*	*-5*	*-5*	*0*	*0*
	21/00	TD	TD	*101*	*184*	*240*	*280*	*238*	*602*	*2*	*5*	*0*	*0*	*5*	*0*	*-10*	*-5*	*-5*	*-5*
	21/06	TD	TD	*152*	*145*	*145*	*152*	*139*	*293*	*0*	*-5*	*-5*	*-5*	*5*	*-5*	*0*	*0*	*0*	*-5*
	21/12	TD	TD	*113*	*112*	*101*	*67*	*131*	*346*	*0*	*-5*	*-5*	*-5*	*0*	*-5*	*0*	*0*	*0*	*0*
	21/18	TS	TS	**11**	**82**	**79**	**60**	**184**	**328**	**-5**	**-5**	**-5**	**-10**	**0**	**0**	**0**	**0**	**5**	**0**
	22/00	TS	TS	**44**	**154**	**79**	**55**	**109**	**186**	**0**	**-5**	**-10**	**0**	**-5**	**-5**	**0**	**5**	**0**	**5**
	22/06	TS	TS	**57**	**62**	**0**	**22**	**116**	**283**	**0**	**-5**	**-10**	**5**	**-12**	**-5**	**0**	**5**	**-5**	**10**
	22/12	TS	TS	**0**	**46**	**24**	**24**	**105**	**351**	**-5**	**0**	**-15**	**0**	**-18**	**0**	**-5**	**10**	**0**	**15**
	22/18	TS	TS	**0**	**81**	**75**	**79**	**187**		**0**	**-5**	**-15**	**-5**		**-5**	**0**	**10**	**5**	
	23/00	STS	TS	**11**	**132**	**81**	**85**	**166**		**0**	**-5**	**-5**	**-10**		**-5**	**0**	**5**	**10**	
	23/06	STS	STS	**46**	**112**	**46**	**132**	**351**		**5**	**-5**	**5**	**-12**		**-5**	**5**	**0**	**15**	
	23/12	STS	STS	**11**	**11**	**31**	**152**	**363**		**5**	**-5**	**0**	**-18**		**-5**	**5**	**5**	**20**	
	23/18	STS	STS	**22**	**32**	**94**	**317**			**5**	**-5**	**-5**			**-5**	**5**	**10**		
	24/00	STS	STS	**0**	**84**	**138**	**236**			**0**	**0**	**-5**			**0**	**5**	**10**		
	24/06	STS	STS	**0**	**57**	**120**	**322**			**-5**	**5**	**-12**			**5**	**0**	**15**		
	24/12	STS	TS	**0**	**35**	**111**	**276**			**-10**	**5**	**-18**			**10**	**0**	**20**		
	24/18	STS	STS	**0**	**70**	**152**				**-10**	**0**				**10**	**5**			
	25/00	STS	STS	**11**	**63**	**132**				**0**	**0**				**5**	**5**			
	25/06	STS	STS	**0**	**68**	**170**				**5**	**-7**				**0**	**10**			
	25/12	STS	STS	**0**	**72**	**123**				**0**	**-8**				**5**	**10**			
	25/18	STS	STS	**11**	**85**					**-5**					**10**				
	26/00	STS	STS	**0**	**53**					**-10**					**15**				
	26/06	STS	STS	**0**	**85**					**0**					**5**				
	26/12	STS	STS	**43**	**140**					**-2**					**5**				
	26/18	STS	STS	**0**															
	27/00	TS	STS	**0**															
	27/06	TS	TS	**0**															
	27/12	TS	TS	**24**															
Initial: TS/STS/TY			**mean**	**12**	**76**	**91**	**147**	**198**	**287**	**-2**	**-3**	**-8**	**-6**	**-9**	**2**	**3**	**8**	**6**	**8**
Valid: TS/STS/TY			**sample**	**24**	**20**	**16**	**12**	**8**	**4**	**20**	**16**	**12**	**8**	**4**	**20**	**16**	**12**	**8**	**4**
Initial: TD(before upg.)			*mean*	*63*	*157*	*196*	*236*	*285*	*538*	*1*	*1*	*0*	*-3*	*1*	*0*	*-4*	*-3*	*-1*	*-2*
Valid: TD/TS/STS/TY			*sample*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Kong-rey(2421)																			
Oct.	24/00	TD	TD	*104*	*103*	*269*	*358*	*272*	*262*	*2*	*4*	*2*	*16*	*32*	*0*	*0*	*0*	*-15*	*-30*
	24/06	TD	TD	*134*	*144*	*270*	*280*	*288*	*248*	*0*	*0*	*4*	*15*	*35*	*0*	*5*	*-5*	*-15*	*-30*
	24/12	TD	TD	*203*	*109*	*246*	*235*	*237*	*153*	*0*	*0*	*9*	*15*	*40*	*0*	*5*	*-10*	*-15*	*-35*
	24/18	TS	TD	**224**	**143**	**308**	**139**	**144**	**246**	**0**	**0**	**5**	**15**	**45**	**0**	**0**	**-5**	**-15**	**-35**
	25/00	TS	TS	**230**	**288**	**254**	**163**	**163**	**337**	**-2**	**-4**	**0**	**15**	**45**	**5**	**5**	**0**	**-15**	**-35**
	25/06	TS	TS	**257**	**267**	**222**	**210**	**225**	**401**	**0**	**0**	**10**	**25**	**35**	**5**	**0**	**-10**	**-20**	**-30**
	25/12	TS	TS	**58**	**162**	**169**	**169**	**191**	**423**	**0**	**5**	**10**	**30**	**25**	**5**	**-5**	**-10**	**-25**	**-20**
	25/18	TS	TS	**24**	**208**	**109**	**109**	**191**	**328**	**0**	**5**	**10**	**35**	**25**	**0**	**-5**	**-10**	**-25**	**-20**
	26/00	TS	TS	**0**	**177**	**48**	**100**	**214**	**303**	**0**	**10**	**20**	**45**	**15**	**0**	**-10**	**-20**	**-35**	**-15**
	26/06	TS	TS	**0**	**178**	**108**	**153**	**236**	**360**	**4**	**5**	**10**	**10**	**-15**	**-5**	**-5**	**-5**	**-10**	**10**
	26/12	TS	TS	**31**	**155**	**115**	**157**	**293**	**478**	**5**	**0**	**15**	**5**	**-35**	**-10**	**-5**	**-10**	**-5**	**30**
	26/18	TS	TS	**57**	**102**	**72**	**144**	**241**	**302**	**0**	**5**	**25**	**5**	**-45**	**-5**	**-10**	**-15**	**-5**	**40**
	27/00	TS	TS	**57**	**48**	**94**	**148**	**238**	**238**	**5**	**10**	**25**	**-15**	**-49**	**-10**	**-15**	**-20**	**5**	**45**
	27/06	TS	TS	**123**	**44**	**64**	**84**	**196**	**270**	**5**	**10**	**10**	**-25**	**-51**	**-10**	**-15**	**-10**	**15**	**45**
	27/12	STS	TS	**93**	**74**	**31**	**117**	**259**		**5**	**20**	**5**	**-45**		**-10**	**-15**	**-5**	**35**	
	27/18	STS	TS	**0**	**44**	**25**	**94**	**117**		**5**	**25**	**-5**	**-40**		**-10**	**-15**	**5**	**40**	
	28/00	STS	STS	**46**	**33**	**39**	**68**	**175**		**15**	**25**	**-15**	**-4**		**-15**	**-20**	**10**	**10**	
	28/06	STS	STS	**49**	**64**	**15**	**91**	**297**		**15**	**0**	**-25**	**-4**		**-10**	**-5**	**20**	**5**	
	28/12	STS	STS	**31**	**34**	**30**	**142**			**15**	**-5**	**-30**			**-10**	**0**	**30**		
	28/18	TY	STS	**15**	**32**	**25**	**73**			**15**	**-15**	**-10**			**-10**	**5**	**15**		
	29/00	TY	TY	**33**	**15**	**0**	**109**			**20**	**-25**	**-4**			**-15**	**10**	**10**		
	29/06	TY	TY	**0**	**10**	**39**	**238**			**-10**	**-20**	**-4**			**0**	**15**	**5**		
	29/12	TY	TY	**22**	**22**	**54**				**-15**	**-10**				**5**	**10**			
	29/18	TY	TY	**11**	**11**	**24**				**-15**	**-10**				**5**	**10**			
	30/00	TY	TY	**0**	**25**	**46**				**-35**	**-9**				**20**	**10**			
	30/06	TY	TY	**0**	**47**	**172**				**-35**	**-6**				**25**	**10**			
	30/12	TY	TY	**15**	**23**					**5**					**5**				
	30/18	TY	TY	**10**	**23**					**0**					**10**				
	31/00	TY	TY	**10**	**45**					**-2**					**10**				
	31/06	TY	TY	**0**	**81**					**2**					**0**				
	31/12	STS	TY	**15**															
	31/18	TS	STS	**0**															
Nov.	01/00	TS	TS	**20**															
	01/06	TS	TS	**15**															
Initial: TS/STS/TY			**mean**	**47**	**87**	**90**	**132**	**212**	**335**	**0**	**1**	**3**	**3**	**0**	**-1**	**-2**	**-1**	**-3**	**1**
Valid: TS/STS/TY			**sample**	**31**	**27**	**23**	**19**	**15**	**11**	**27**	**23**	**19**	**15**	**11**	**27**	**23**	**19**	**15**	**11**
Initial: TD(before upg.)			*mean*	*147*	*119*	*262*	*291*	*266*	*221*	*1*	*1*	*5*	*15*	*36*	*0*	*3*	*-5*	*-15*	*-32*
Valid: TD/TS/STS/TY			*sample*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
Yinxing(2422)																			
Nov.	03/00	TD	TD	*102*	*90*	*197*	*281*	*343*	*489*	*2*	*21*	*20*	*35*	*0*	*-5*	*-35*	*-30*	*-40*	*-10*
	03/06	TD	TD	*35*	*185*	*216*	*362*	*419*	*649*	*4*	*21*	*25*	*40*	*0*	*-10*	*-35*	*-35*	*-45*	*-10*
	03/12	TS	TD	**0**	**131**	**239**	**309**	**395**	**582**	**8**	**24**	**25**	**15**	**0**	**-20**	**-40**	**-40**	**-30**	**-15**
	03/18	TS	TS	**0**	**86**	**206**	**245**	**469**	**616**	**11**	**22**	**35**	**10**	**5**	**-25**	**-35**	**-40**	**-20**	**-15**
	04/00	TS	TS	**16**	**99**	**154**	**192**	**303**	**379**	**10**	**5**	**20**	**-10**	**5**	**-20**	**-15**	**-25**	**0**	**-15**
	04/06	TS	TS	**0**	**101**	**134**	**195**	**311**	**368**	**5**	**5**	**25**	**-10**	**5**	**-15**	**-15**	**-30**	**0**	**-15**
	04/12	STS	TS	**11**	**65**	**64**	**148**	**292**	**315**	**10**	**10**	**5**	**-5**	**5**	**-20**	**-20**	**-15**	**-5**	**-15**
	04/18	TY	STS	**15**	**48**	**31**	**97**	**221**	**252**	**5**	**15**	**0**	**0**	**10**	**-15**	**-20**	**-5**	**-5**	**-15**
	05/00	TY	TY	**11**	**25**	**54**	**163**	**322**	**316**	**0**	**10**	**-20**	**-5**	**0**	**-5**	**-15**	**10**	**-5**	**-5**
	05/06	TY	TY	**40**	**33**	**39**	**138**	**218**	**177**	**-5**	**15**	**-10**	**10**	**0**	**-5**	**-20**	**5**	**-15**	**-5**
	05/12	TY	TY	**15**	**25**	**84**	**202**	**300**	**253**	**0**	**5**	**0**	**15**	**0**	**-10**	**-10**	**-5**	**-20**	**-5**
	05/18	TY	TY	**15**	**35**	**46**	**201**	**228**	**126**	**10**	**0**	**5**	**15**	**0**	**-15**	**-5**	**-10**	**-20**	**-5**
	06/00	TY	TY	**0**	**15**	**55**	**127**	**55**	**82**	**10**	**-10**	**10**	**5**	**0**	**-15**	**5**	**-15**	**-10**	**-5**
	06/06	TY	TY	**0**	**44**	**67**	**127**	**67**	**53**	**15**	**-10**	**10**	**0**	**0**	**-20**	**5**	**-15**	**-5**	**-5**
	06/12	TY	TY	**0**	**15**	**64**	**86**	**94**	**92**	**-5**	**0**	**15**	**2**	**2**	**-5**	**-5**	**-20**	**-10**	**-5**
	06/18	TY	TY	**11**	**24**	**32**	**33**	**75**	**87**	**5**	**10**	**20**	**6**	**6**	**-10**	**-15**	**-25**	**-15**	**-5**
	07/00	TY	TY	**0**	**11**	**46**	**24**	**69**	**200**	**-10**	**15**	**10**	**6**	**6**	**5**	**-20**	**-15**	**-15**	**-5**
	07/06	TY	TY	**0**	**11**	**39**	**33**	**155**		**-5**	**10**	**0**	**4**		**0**	**-15**	**-5**	**-10**	
	07/12	TY	TY	**15**	**31**	**35**	**67**	**147**		**-5**	**5**	**-5**	**0**		**0**	**-10**	**0**	**0**	
	07/18	TY	TY	**0**	**15**	**22**	**109**	**172**		**0**	**10**	**-2**	**4**		**-5**	**-15**	**0**	**-5**	
	08/00	TY	TY	**15**	**31**	**22**	**124**	**226**		**5**	**0**	**-2**	**4**		**-10**	**-5**	**0**	**-5**	
	08/06	TY	TY	**11**	**39**	**54**	**175**			**-5**	**-5**	**-2**			**-5**	**0**	**0**		
	08/12	TY	TY	**11**	**39**	**35**	**126**			**10**	**0**	**0**			**-15**	**-5**	**0**		
	08/18	TY	TY	**11**	**25**	**79**	**193**			**5**	**-2**	**8**			**-10**	**0**	**-5**		
	09/00	TY	TY	**15**	**25**	**55**	**132**			**0**	**-2**	**6**			**-5**	**0**	**-5**		
	09/06	TY	TY	**0**	**21**	**119**				**0**	**4**				**-5**	**-10**			
	09/12	TY	TY	**11**	**15**	**101**				**-5**	**0**				**0**	**0**			
	09/18	TY	TY	**0**	**39**	**104**				**-4**	**0**				**5**	**0**			
	10/00	TY	TY	**15**	**25**	**67**				**-4**	**-2**				**5**	**0**			
	10/06	TY	TY	**22**	**70**					**-4**					**5**				
	10/12	STS	TY	**46**	**49**					**-6**					**10**				
	10/18	STS	STS	**113**	**25**					**-2**					**5**				
	11/00	STS	TS	**32**	**33**					**2**					**-5**				
	11/06	STS	TS	**39**															
	11/12	TS	TS	**0**															
	11/18	TS	TS	**25**															
	12/00	TS	TS	**0**															
Initial: TS/STS/TY			**mean**	**15**	**40**	**76**	**141**	**217**	**260**	**2**	**5**	**7**	**3**	**3**	**-7**	**-11**	**-11**	**-10**	**-9**
Valid: TS/STS/TY			**sample**	**35**	**31**	**27**	**23**	**19**	**15**	**31**	**27**	**23**	**19**	**15**	**31**	**27**	**23**	**19**	**15**
Initial: TD(before upg.)			*mean*	*69*	*137*	*207*	*321*	*381*	*569*	*3*	*21*	*23*	*38*	*0*	*-8*	*-35*	*-33*	*-43*	*-10*
Valid: TD/TS/STS/TY			*sample*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time (UTC)		Grade Best	Grade Prov.	Center Position (km) T=0‡	=24	=48	=72	=96	=120	Central Pressure (hPa) T=24	=48	=72	=96	=120	Max. Wind Speed (kt)† T=24	=48	=72	=96	=120
								Toraji(2423)											
Nov.	08/18	TD	TD	*22*	*87*	*122*	*198*	*236*	*258*	*4*	*18*	*2*	*4*	*0*	*-10*	*-30*	*-5*	*-5*	*0*
	09/00	TD	TD	*11*	*85*	*117*	*178*	*237*	*290*	*6*	*12*	*0*	*-4*	*-8*	*-15*	*-20*	*0*	*10*	*15*
	09/06	TS	TS	**24**	**183**	**258**	**158**	**234**	**214**	**8**	**0**	**-2**	**-4**	**-2**	**-15**	**0**	**5**	**10**	**5**
	09/12	TS	TS	**15**	**44**	**106**	**91**	**178**		**7**	**6**	**0**	**-4**		**-10**	**-10**	**0**	**5**	
	09/18	TS	TS	**44**	**32**	**55**	**113**	**143**		**0**	**2**	**4**	**0**		**-5**	**-5**	**-5**	**0**	
	10/00	STS	STS	**0**	**54**	**25**	**91**	**70**		**-5**	**2**	**-2**	**-2**		**0**	**-5**	**5**	**5**	
	10/06	STS	STS	**11**	**55**	**69**	**109**	**100**		**-5**	**0**	**2**	**6**		**5**	**0**	**0**	**-5**	
	10/12	TY	STS	**25**	**21**	**100**	**84**			**0**	**-2**	**0**			**0**	**5**	**0**		
	10/18	TY	TY	**0**	**34**	**80**	**61**			**0**	**-2**	**-4**			**0**	**5**	**5**		
	11/00	TY	TY	**34**	**32**	**54**	**76**			**0**	**-4**	**-2**			**0**	**10**	**5**		
	11/06	STS	TY	**25**	**24**	**35**	**68**			**-2**	**-4**	**-2**			**5**	**10**	**5**		
	11/12	STS	STS	**33**	**43**	**79**				**-2**	**-4**				**5**	**5**			
	11/18	STS	STS	**15**	**77**	**100**				**0**	**0**				**0**	**0**			
	12/00	STS	STS	**21**	**38**	**91**				**-6**	**-2**				**10**	**5**			
	12/06	TS	TS	**21**	**44**	**103**				**-6**	**0**				**10**	**0**			
	12/12	TS	TS	**35**	**67**					**-8**					**10**				
	12/18	TS	TS	**10**	**33**					**-2**					**0**				
	13/00	TS	TS	**0**	**35**					**0**					**0**				
	13/06	TS	TS	**11**	**64**					**0**					**0**				
	13/12	TS	TS	**25**															
	13/18	TS	TS	**39**															
	14/00	TS	TS	**11**															
	14/06	TS	TS	**0**															
Initial: TS/STS/TY		**mean**		**19**	**52**	**89**	**95**	**145**	**214**	**-1**	**-1**	**-1**	**-1**	**-2**	**1**	**2**	**2**	**3**	**5**
Valid: TS/STS/TY		**sample**		**21**	**17**	**13**	**9**	**5**	**1**	**17**	**13**	**9**	**5**	**1**	**17**	**13**	**9**	**5**	**1**
Initial: TD(before upg.)		*mean*		*16*	*86*	*120*	*188*	*236*	*274*	*5*	*15*	*1*	*0*	*-4*	*-13*	*-25*	*-3*	*3*	*8*
Valid: TD/TS/STS/TY		*sample*		*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time (UTC)		Grade Best	Grade Prov.	Center Position (km) T=0‡	=24	=48	=72	=96	=120	Central Pressure (hPa) T=24	=48	=72	=96	=120	Max. Wind Speed (kt)† T=24	=48	=72	=96	=120
								Man-yi(2424)											
Nov.	09/00	TS	TD	**11**	**49**	**316**	**494**			**4**	**6**	**10**			**-5**	**-10**	**-15**		
	09/06	TS	TS	**15**	**82**	**302**	**289**			**2**	**2**	**4**			**-5**	**-5**	**-10**		
	09/12	TS	TS	**0**	**108**	**312**	**323**			**-2**	**2**	**4**			**5**	**-5**	**-10**		
	09/18	TS	TS	**0**	**141**	**317**	**331**			**-2**	**2**	**4**			**5**	**-5**	**-10**		
	10/00	TS	TS	**0**	**140**	**259**	**313**			**0**	**4**	**6**			**0**	**-10**	**-10**		
	10/06	TS	TS	**25**	**253**	**214**	**392**			**0**	**2**	**6**			**0**	**-5**	**-10**		
	10/12	TS	TS	**0**	**259**	**280**	**331**			**0**	**2**	**6**			**0**	**-5**	**-10**		
	10/18	TS	TS	**15**	**262**	**327**	**436**			**0**	**2**	**10**			**0**	**-5**	**-15**		
	11/00	TS	TS	**46**	**189**	**358**	**455**			**0**	**2**	**16**			**0**	**-5**	**-25**		
	11/06	TS	TS	**0**	**139**	**280**	**338**	**284**	**218**	**-2**	**-2**	**4**	**30**	**70**	**5**	**5**	**-5**	**-20**	**-45**
	11/12	TS	TS	**22**	**171**	**182**	**221**	**211**	**189**	**-2**	**-2**	**0**	**30**	**65**	**5**	**5**	**0**	**-20**	**-40**
	11/18	TS	TS	**22**	**225**	**287**	**288**	**263**	**336**	**-2**	**2**	**5**	**40**	**45**	**5**	**0**	**0**	**-25**	**-30**
	12/00	TS	TS	**58**	**208**	**316**	**303**	**311**	**400**	**-2**	**4**	**10**	**55**	**40**	**5**	**-5**	**-5**	**-30**	**-25**
	12/06	TS	TS	**22**	**156**	**218**	**204**	**178**	**232**	**0**	**0**	**15**	**45**	**30**	**0**	**0**	**-5**	**-20**	**-15**
	12/12	TS	TS	**24**	**109**	**200**	**213**	**196**	**267**	**-2**	**-7**	**15**	**45**	**10**	**5**	**10**	**-5**	**-20**	**0**
	12/18	TS	TS	**54**	**163**	**155**	**148**	**183**	**216**	**2**	**-5**	**25**	**30**	**-5**	**0**	**10**	**-10**	**-15**	**10**
	13/00	TS	TS	**109**	**159**	**130**	**95**	**116**	**101**	**8**	**5**	**45**	**30**	**-5**	**-10**	**0**	**-20**	**-15**	**10**
	13/06	TS	TS	**16**	**112**	**70**	**54**	**70**	**145**	**6**	**20**	**45**	**30**	**-5**	**-5**	**-10**	**-20**	**-15**	**10**
	13/12	TS	TS	**55**	**25**	**56**	**73**	**116**	**157**	**0**	**20**	**45**	**15**	**5**	**0**	**-10**	**-20**	**-5**	**0**
	13/18	TS	TS	**16**	**50**	**31**	**34**	**115**	**94**	**0**	**25**	**25**	**10**	**-2**	**5**	**-10**	**-10**	**-5**	**10**
	14/00	STS	STS	**33**	**60**	**34**	**34**	**57**	**35**	**5**	**40**	**15**	**5**	**-8**	**0**	**-15**	**-5**	**0**	**15**
	14/06	STS	STS	**16**	**40**	**54**	**65**	**39**	**15**	**15**	**30**	**15**	**5**	**-14**	**-5**	**-10**	**-5**	**0**	**25**
	14/12	STS	STS	**45**	**40**	**66**	**86**	**110**		**15**	**30**	**5**	**0**		**-5**	**-10**	**5**	**5**	
	14/18	STS	STS	**11**	**16**	**11**	**64**	**81**		**25**	**15**	**5**	**0**		**-10**	**-5**	**0**	**5**	
	15/00	TY	TY	**11**	**11**	**40**	**56**	**70**		**35**	**5**	**-5**	**-8**		**-20**	**-5**	**5**	**10**	
	15/06	TY	TY	**11**	**22**	**39**	**25**	**59**		**30**	**5**	**-5**	**-6**		**-15**	**-5**	**5**	**5**	
	15/12	TY	TY	**0**	**43**	**54**	**69**			**20**	**15**	**0**			**-10**	**-10**	**0**		
	15/18	TY	TY	**0**	**0**	**49**	**44**			**0**	**15**	**0**			**0**	**-15**	**0**		
	16/00	TY	TY	**11**	**22**	**15**	**46**			**-15**	**10**	**-6**			**5**	**-10**	**5**		
	16/06	TY	TY	**11**	**74**	**42**	**46**			**-15**	**10**	**-10**			**5**	**-10**	**10**		
	16/12	TY	TY	**0**	**35**	**22**				**30**	**0**				**-30**	**0**			
	16/18	TY	TY	**0**	**54**	**44**				**15**	**-2**				**-15**	**5**			
	17/00	TY	TY	**0**	**63**	**118**				**12**	**0**				**-10**	**0**			
	17/06	TY	TY	**15**	**44**	**53**				**12**	**-6**				**-10**	**10**			
	17/12	TY	TY	**15**	**15**					**0**					**0**				
	17/18	TY	TY	**0**	**44**					**-7**					**10**				
	18/00	TY	TY	**11**	**64**					**-4**					**0**				
	18/06	TY	TY	**0**	**75**					**-10**					**10**				
	18/12	STS	STS	**0**															
	18/18	STS	STS	**15**															
	19/00	TS	STS	**31**															
	19/06	TS	TS	**34**															
Initial: TS/STS/TY			**mean**	**19**	**98**	**154**	**196**	**145**	**185**	**5**	**7**	**10**	**21**	**17**	**-2**	**-4**	**-7**	**-10**	**-6**
Valid: TS/STS/TY			**sample**	**42**	**38**	**34**	**30**	**17**	**13**	**38**	**34**	**30**	**17**	**13**	**38**	**34**	**30**	**17**	**13**
Initial: TD(before upg.)			*mean*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Valid: TD/TS/STS/TY			*sample*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Usagi(2425)											
Nov.	10/00	TD	TD	*11*	*86*	*141*	*170*	*224*	*207*	*0*	*0*	*12*	*50*	*0*	*5*	*5*	*-10*	*-35*	*5*
	10/06	TD	TD	*0*	*98*	*165*	*238*	*262*	*214*	*-2*	*6*	*22*	*35*	*2*	*5*	*-5*	*-20*	*-25*	*-5*
	10/12	TD	TD	*11*	*130*	*189*	*233*	*252*	*293*	*-2*	*8*	*32*	*10*	*0*	*5*	*-10*	*-25*	*-5*	*0*
	10/18	TD	TD	*16*	*107*	*171*	*193*	*168*	*263*	*0*	*8*	*42*	*5*	*-4*	*0*	*-10*	*-35*	*0*	*5*
	11/00	TD	TD	*0*	*87*	*120*	*149*	*122*	*123*	*6*	*18*	*52*	*0*	*-8*	*-10*	*-20*	*-40*	*5*	*15*
	11/06	TD	TD	*11*	*76*	*118*	*139*	*178*	*226*	*8*	*22*	*30*	*-2*	*-10*	*-10*	*-20*	*-20*	*10*	*20*
	11/12	TD	TD	*0*	*73*	*86*	*120*	*135*	*93*	*10*	*32*	*5*	*-4*	*-12*	*-15*	*-25*	*0*	*15*	*20*
	11/18	TS	TS	**16**	**43**	**54**	**47**	**135**		**6**	**40**	**0**	**-8**		**-5**	**-30**	**5**	**20**	
	12/00	TS	TS	**0**	**32**	**44**	**71**			**5**	**40**	**-5**			**-5**	**-30**	**5**		
	12/06	STS	STS	**0**	**21**	**40**	**43**			**10**	**20**	**-12**			**-15**	**-20**	**10**		
	12/12	STS	STS	**0**	**11**	**15**	**47**			**10**	**-5**	**-14**			**-10**	**0**	**15**		
	12/18	STS	TY	**0**	**24**	**35**	**98**			**15**	**-10**	**-18**			**-15**	**5**	**20**		
	13/00	TY	TY	**11**	**46**	**76**				**25**	**-15**				**-20**	**10**			
	13/06	TY	TY	**0**	**70**	**104**				**10**	**-17**				**-10**	**15**			
	13/12	TY	TY	**15**	**35**	**99**				**-30**	**-14**				**20**	**15**			
	13/18	TY	TY	**11**	**44**	**89**				**-25**	**-13**				**20**	**20**			
	14/00	TY	TY	**0**	**39**					**-30**					**25**				
	14/06	TY	TY	**0**	**33**					**-12**					**15**				
	14/12	TY	TY	**0**	**62**					**-4**					**10**				
	14/18	STS	STS	**0**	**15**					**0**					**0**				
	15/00	STS	STS	**0**															
	15/06	STS	STS	**10**															
	15/12	TS	TS	**46**															
	15/18	TS	TS	**91**															
Initial: TS/STS/TY			**mean**	**12**	**37**	**62**	**61**	**135**	**--**	**-2**	**3**	**-10**	**-8**	**--**	**1**	**-2**	**11**	**20**	**--**
Valid: TS/STS/TY			**sample**	**17**	**13**	**9**	**5**	**1**	**0**	**13**	**9**	**5**	**1**	**0**	**13**	**9**	**5**	**1**	**0**
Initial: TD(before upg.)			*mean*	*7*	*94*	*142*	*177*	*192*	*203*	*3*	*13*	*28*	*13*	*-5*	*-3*	*-12*	*-21*	*-5*	*9*
Valid: TD/TS/STS/TY			*sample*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

Date/Time		Grade		Center Position (km)						Central Pressure (hPa)					Max. Wind Speed (kt)†				
	(UTC)	Best	Prov.	T=0‡	=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120	T=24	=48	=72	=96	=120
								Pabuk(2426)											
Dec.	22/00	TD	TD	*137*	*55*	*73*	*125*			*-2*	*-2*	*0*			*0*	*0*	*0*		
	22/06	TS	TD	**112**	**40**	**99**				**-4**	**-4**				**0**	**0**			
	22/12	TS	TD	**22**	**69**	**142**				**-4**	**-4**				**0**	**0**			
	22/18	TS	TD	**94**	**99**					**-2**					**0**				
	23/00	TS	TD	**11**	**120**					**0**					**0**				
	23/06	TS	TS	**16**	**113**					**0**					**0**				
	23/12	TS	TS	**40**	**118**					**0**					**0**				
	23/18	TS	TS	**35**															
	24/00	TS	TS	**11**															
	24/06	TS	TS	**40**															
	24/12	TS	TS	**71**															
Initial: TS/STS/TY			**mean**	**45**	**93**	**120**	**--**	**--**	**--**	**-2**	**-4**	**--**	**--**	**--**	**0**	**0**	**--**	**--**	**--**
Valid: TS/STS/TY			**sample**	**10**	**6**	**2**	**0**	**0**	**0**	**6**	**2**	**0**	**0**	**0**	**6**	**2**	**0**	**0**	**0**
Initial: TD(before upg.)			*mean*	*137*	*55*	*73*	*125*	*--*	*--*	*-2*	*-2*	*0*	*--*	*--*	*0*	*0*	*0*	*--*	*--*
Valid: TD/TS/STS/TY			*sample*	*1*	*1*	*1*	*1*	*0*	*0*	*1*	*1*	*1*	*0*	*0*	*1*	*1*	*1*	*0*	*0*

†Max. wind speed for TDs are treated as 30 kt in this validation

‡Position error of provisional analysis

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 - 2024

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1951		1	1	2	1	1	3	3	2	4	1	2	21
1952						3	3	5	3	6	3	4	27
1953		1			1	2	1	6	3	5	3	1	23
1954			1		1		1	5	5	4	3	1	21
1955	1	1	1	1		2	7	6	4	3	1	1	28
1956			1	2		1	2	5	6	1	4	1	23
1957	2			1	1	1	1	4	5	4	3		22
1958	1			1	1	4	7	5	5	3	2	2	31
1959		1	1	1			2	5	5	4	2	2	23
1960				1	1	3	3	10	3	4	1	1	27
1961	1		1		2	3	4	6	6	4	1	1	29
1962		1		1	2		5	8	4	5	3	1	30
1963				1		4	4	3	5	4		3	24
1964					2	2	7	5	6	5	6	1	34
1965	2	1	1	1	2	3	5	6	7	2	2		32
1966				1	2	1	4	10	9	5	2	1	35
1967		1	2	1	1	1	7	9	9	4	3	1	39
1968				1	1	1	3	8	3	5	5		27
1969	1		1	1			3	4	3	3	2	1	19
1970		1				2	3	6	5	5	4		26
1971	1		1	3	4	2	8	5	6	4	2		36
1972	1				1	3	7	5	4	5	3	2	31
1973							7	5	2	4	3		21
1974	1		1	1	1	4	4	5	5	4	4	2	32
1975	1						2	4	5	5	3	1	21
1976	1	1		2	2	2	4	4	5	1	1	2	25
1977			1			1	3	3	5	5	1	2	21
1978	1			1		3	4	8	5	4	4		30
1979	1		1	1	2		4	2	6	3	2	2	24
1980				1	4	1	4	2	6	4	1	1	24
1981			1	2		3	4	8	4	2	3	2	29
1982			3		1	3	3	5	5	3	1	1	25
1983						1	3	5	2	5	5	2	23
1984						2	5	5	4	7	3	1	27
1985	2				1	3	1	8	5	4	1	2	27
1986		1		1	2	2	4	4	3	5	4	3	29
1987	1			1		2	4	4	6	2	2	1	23
1988	1				1	3	2	8	8	5	2	1	31
1989	1			1	2	2	7	5	6	4	3	1	32
1990	1			1	1	3	4	6	4	4	4	1	29
1991			2	1	1	1	4	5	6	3	6		29
1992	1	1				2	4	8	5	7	3		31
1993			1			1	4	7	6	4	2	3	28
1994				1	1	2	7	9	8	6		2	36
1995				1		1	2	6	5	6	1	1	23
1996		1		1	2		6	5	6	2	2	1	26
1997				2	3	3	4	6	4	3	2	1	28
1998							1	3	5	2	3	2	16
1999				2		1	4	6	6	2	1		22
2000					2		5	6	5	2	2	1	23
2001					1	2	5	6	5	3	1	3	26
2002	1	1			1	3	5	6	4	2	2	1	26
2003	1			1	2	2	2	5	3	3	2		21
2004				1	2	5	2	8	3	3	3	2	29
2005	1		1	1	1		5	5	5	2	2		23
2006					1	2	2	7	3	4	2	2	23
2007				1	1		3	4	5	6	4		24
2008				1	4	1	2	4	4	2	3	1	22
2009					2	2	2	5	7	3	1		22
2010			1				2	5	4	2			14
2011					2	3	4	3	7	1		1	21
2012			1		1	4	4	5	3	5	1	1	25
2013	1	1				4	3	6	8	6	2		31
2014	2	1		2		2	5	1	5	2	1	2	23
2015	1	1	2	1	2	2	3	4	5	4	1	1	27
2016							4	7	7	4	3	1	26
2017				1		1	8	6	3	3	3	2	27
2018	1	1	1			4	5	9	4	1	3		29
2019	1	1				1	4	5	6	4	6	1	29
2020					1	1		8	3	6	3	1	23
2021		1		1	1	2	3	4	4	4	1	1	22
2022				2		2	2	5	7	5	1	1	25
2023				1	1	1	3	6	2	2		1	17
2024					2		2	6	8	3	4	1	26
Normal 1991-2020	0.3	0.3	0.3	0.6	1.0	1.7	3.7	5.7	5.0	3.4	2.2	1.0	25.1

Appendix 5
Other Verification Charts

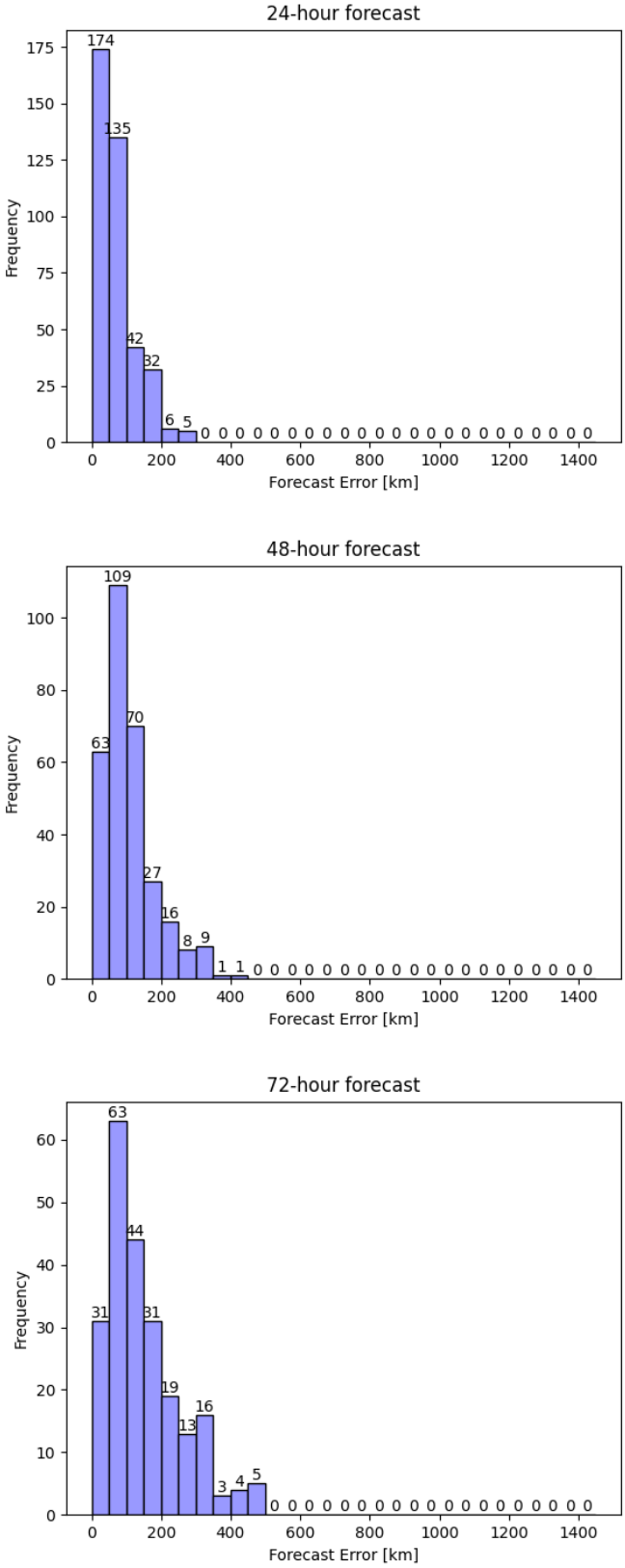


Figure A5.1 Histograms of RSMC 24-, 48- and 72-hour forecast position errors

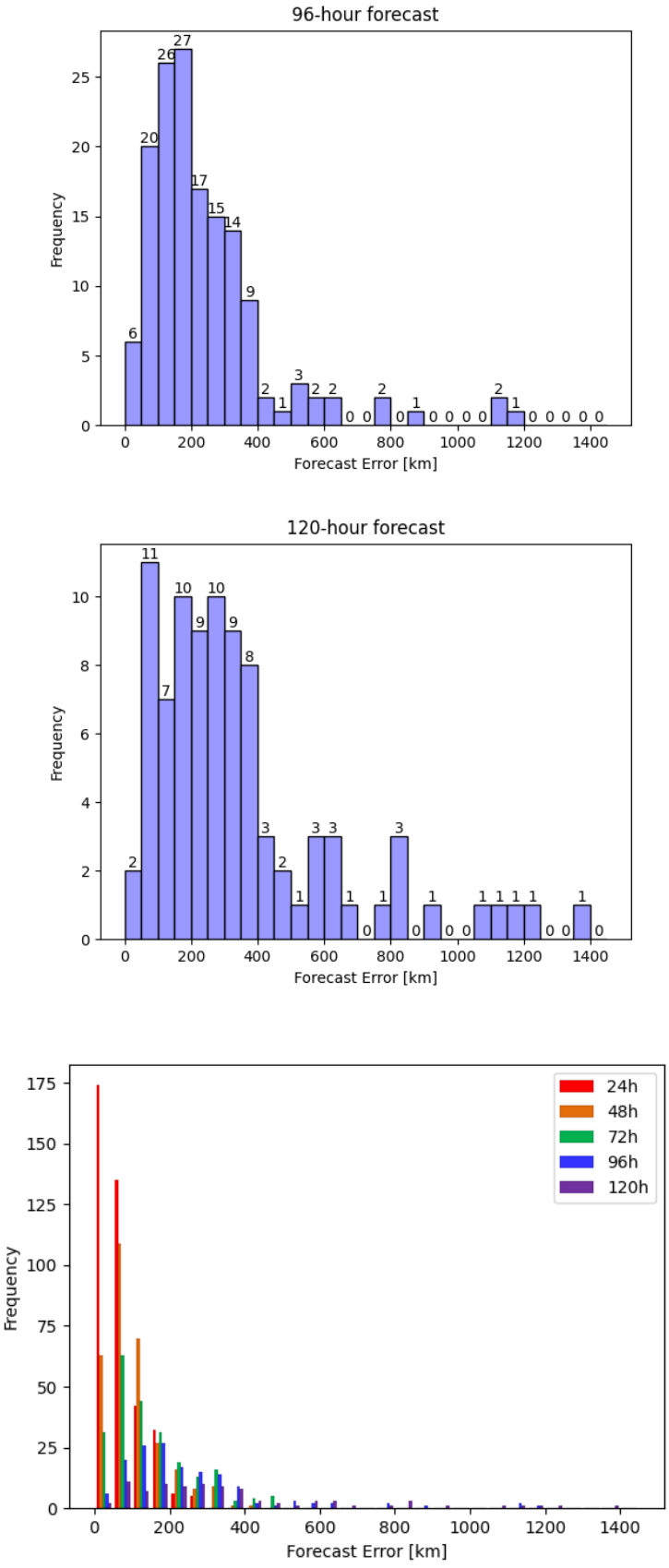


Figure A5.2 Histograms of RSMC 96-hour, 120-hour and all lead time forecast position errors

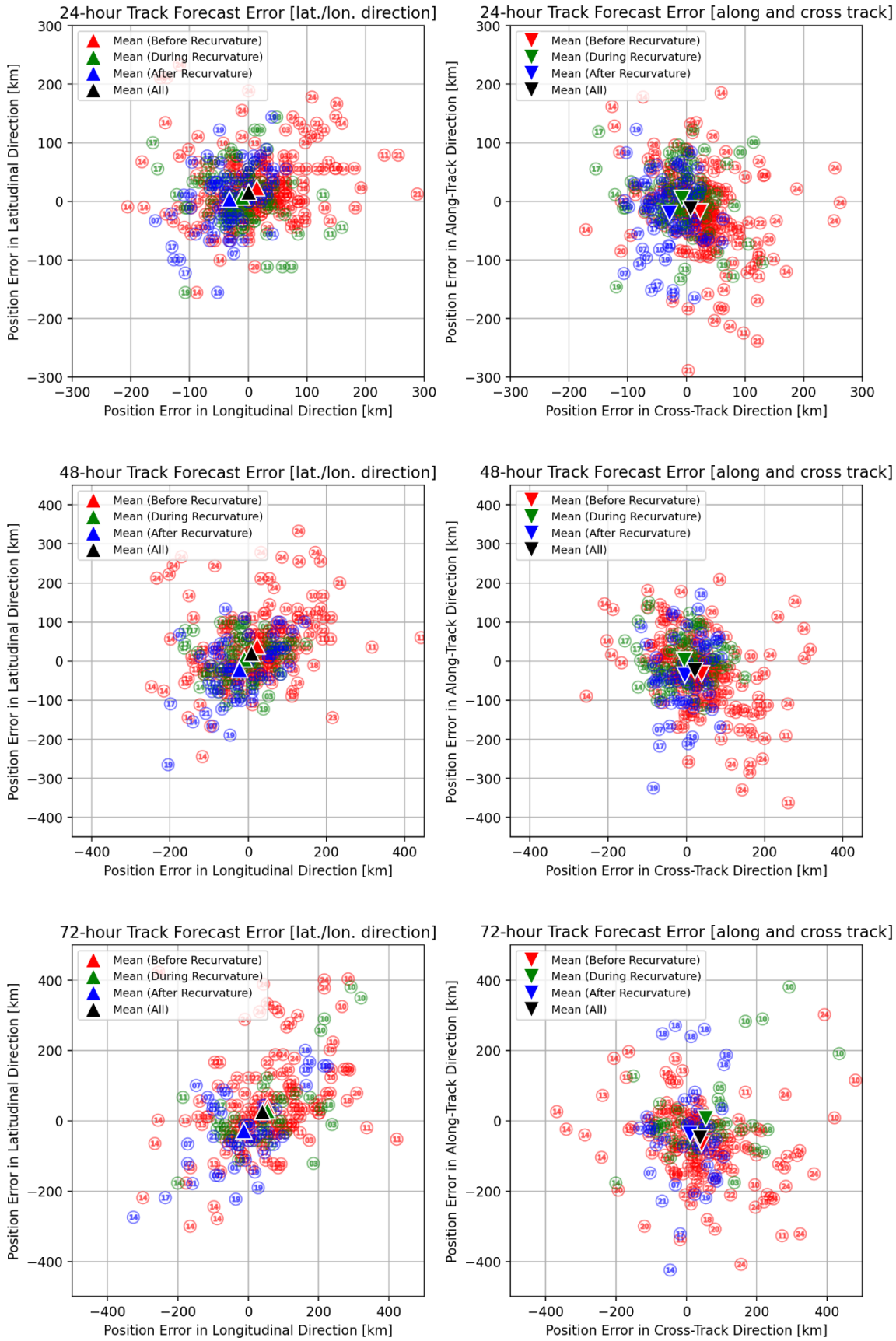


Figure A5.3 Scatter diagrams of RSMC position errors for 24-, 48- and 72-hour forecast in longitudinal/latitudinal and cross/along-track directions: Red, green and blue circles with TC number and triangles denote biases for each initial time and mean biases in the stages before, during and after recurvature, respectively. Black triangles indicate mean bias for all initial time.

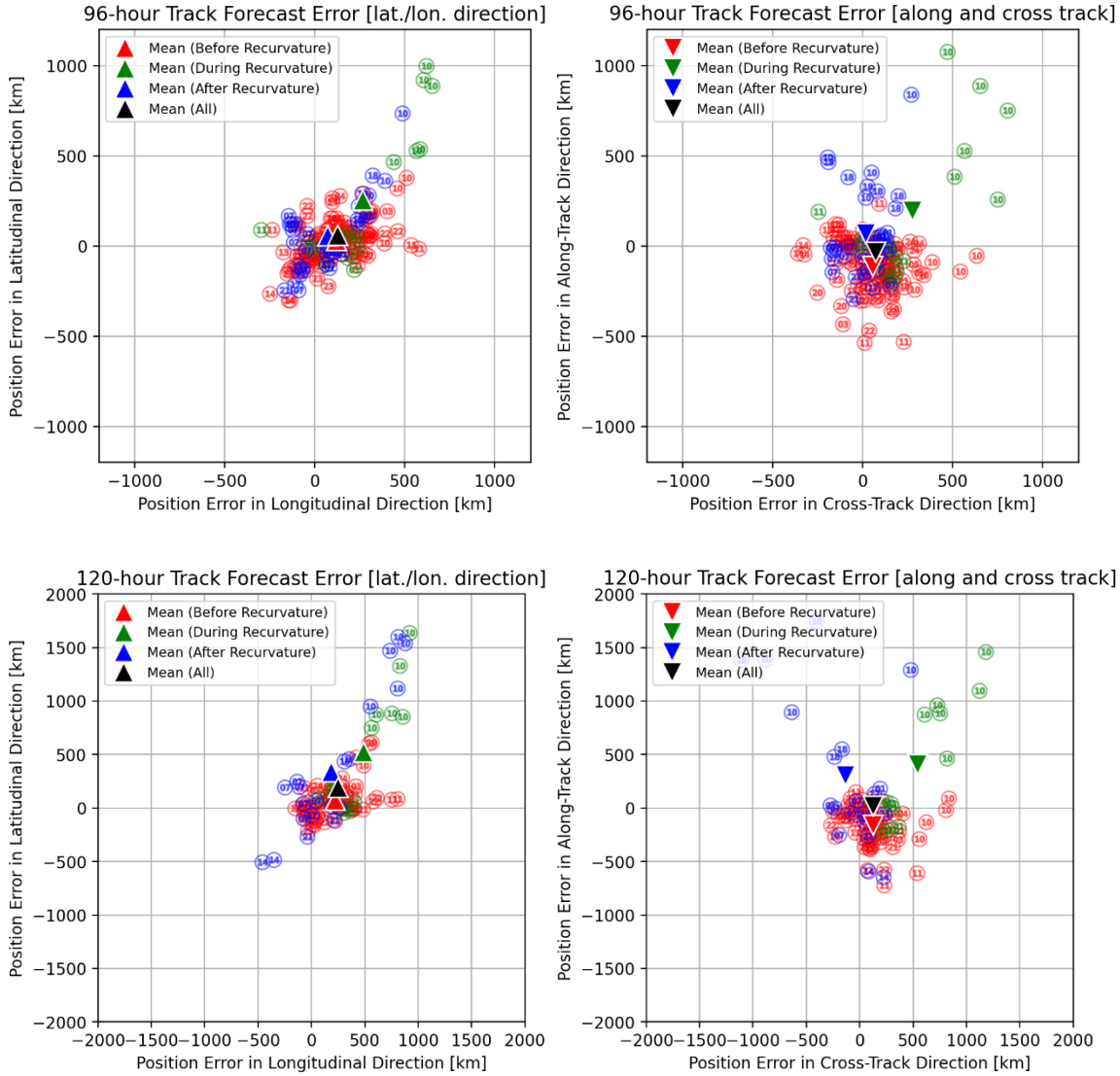


Figure A5.4 Scatter diagrams of RSMC position errors for 96- and 120-hour forecast in longitudinal/latitudinal and cross/along-track directions: Red, green and blue circles with TC number and triangles denote biases for each initial time and mean biases in the stages before, during and after recurvature, respectively. Black triangles indicate mean bias for all initial time.

Table A5.1 Annual mean errors, RMSEs and mean improvement ratios of RSMC maximum wind speed forecasts

Tropical Cyclone			24-hour Forecast				48-hour Forecast				72-hour Forecast				96-hour Forecast				120-hour Forecast			
			Error (m/s)	RMSE (m/s)	Num.	Impr. (%)	Error (m/s)	RMSE (m/s)	Num.	Impr. (%)	Error (m/s)	RMSE (m/s)	Num.	Impr. (%)	Error (m/s)	RMSE (m/s)	Num.	Impr. (%)	Error (m/s)	RMSE (m/s)	Num.	Impr. (%)
TY	Ewiniar	(2401)	-0.9	8.9	17	-101	1.8	7.5	13	-79	1.7	4.9	9	-3	2.6	3.5	5	36	2.6	2.6	1	6
TS	Maliksi	(2402)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Gaemi	(2403)	0.9	4.2	23	25	1.1	6.1	19	16	2.2	7.2	15	24	6.1	10.3	11	-8	14.7	15.9	7	-162
STS	Prapiroon	(2404)	-6.0	7.4	6	-16	-5.1	5.8	2	-35	-	-	0	-	-	-	0	-	-	-	0	-
STS	Maria	(2405)	2.8	5.5	14	-30	3.3	5.3	10	-20	2.1	3.5	6	-210	-1.3	1.8	2	8	-	-	0	-
TS	Son-tinh	(2406)	-0.4	1.0	6	72	-2.6	2.6	2	66	-	-	0	-	-	-	0	-	-	-	0	-
TY	Ampil	(2407)	0.9	4.4	22	40	0.0	3.4	18	66	-2.8	4.8	14	60	-4.6	6.5	10	39	-2.6	2.6	6	46
TS	Wukong	(2408)	0.0	0.0	2	100	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TS	Jongdari	(2409)	0.5	2.6	5	14	0.0	0.0	1	100	-	-	0	-	-	-	0	-	-	-	0	-
TY	Shanshan	(2410)	2.4	6.4	31	10	4.2	8.3	27	22	3.2	8.9	23	19	-1.2	8.9	19	11	-8.1	10.8	15	-2
TY	Yagi	(2411)	-3.4	7.1	25	32	-7.1	9.3	21	43	-10.1	14.0	17	24	-9.1	14.6	13	20	-4.0	11.2	9	17
TS	Leepi	(2412)	-2.6	2.6	1	-6	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Bebinca	(2413)	1.9	5.0	22	12	0.9	6.6	18	23	-0.4	5.9	14	24	-4.4	5.1	10	-18	-4.7	5.5	6	25
TS	Pulasan	(2414)	-1.4	1.9	19	47	-1.4	1.9	13	77	-2.0	2.6	9	81	0.9	2.6	3	86	-3.9	4.1	2	76
TS	Soulik	(2415)	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TS	Cimaron	(2416)	0.0	0.0	1	100	-	-	0	-	-	-	0	-	-	-	0	-	-	-	0	-
TY	Jebi	(2417)	0.7	4.8	18	3	0.7	3.6	14	55	-1.8	2.9	10	57	-8.6	9.6	6	-278	-10.3	10.6	2	-131
TY	Krathon	(2418)	-1.1	7.3	18	8	-2.4	8.9	14	37	-7.2	8.8	10	42	-2.1	7.2	6	35	3.9	4.1	2	-103
TS	Barijat	(2419)	-0.2	0.7	12	72	-0.6	2.2	8	50	0.6	1.3	4	74	-	-	0	-	-	-	0	-
STS	Trami	(2420)	0.9	3.3	20	25	1.4	2.5	16	42	4.1	5.0	12	-0	3.2	5.1	8	1	3.9	4.8	4	38
TY	Kong-rey	(2421)	-0.5	5.1	27	22	-1.1	5.3	23	48	-0.7	6.9	19	43	-1.5	10.9	15	21	0.7	16.3	11	-21
TY	Yinxing	(2422)	-3.7	6.0	31	20	-5.4	7.8	27	18	-5.8	9.0	23	14	-5.3	6.7	19	23	-4.6	5.3	15	39
TY	Toraji	(2423)	0.5	3.4	17	48	0.8	3.0	13	62	1.1	2.1	9	79	1.5	3.0	5	70	2.6	2.6	1	72
TY	Man-yi	(2424)	-1.2	4.4	38	26	-2.1	4.0	34	62	-3.3	5.5	30	58	-5.0	7.9	17	47	-3.0	11.6	13	18
TY	Usagi	(2425)	0.4	7.6	13	21	-0.9	9.7	9	19	5.7	6.4	5	26	10.3	10.3	1	-5	-	-	0	-
TS	Pabuk	(2426)	0.0	0.0	6	100	0.0	0.0	2	100	-	-	0	-	-	-	0	-	-	-	0	-
Annual Mean (Total)			-0.3	5.3	394	17	-0.7	6.2	304	37	-1.5	7.3	229	36	-2.5	8.6	150	24	-2.1	10.5	94	2

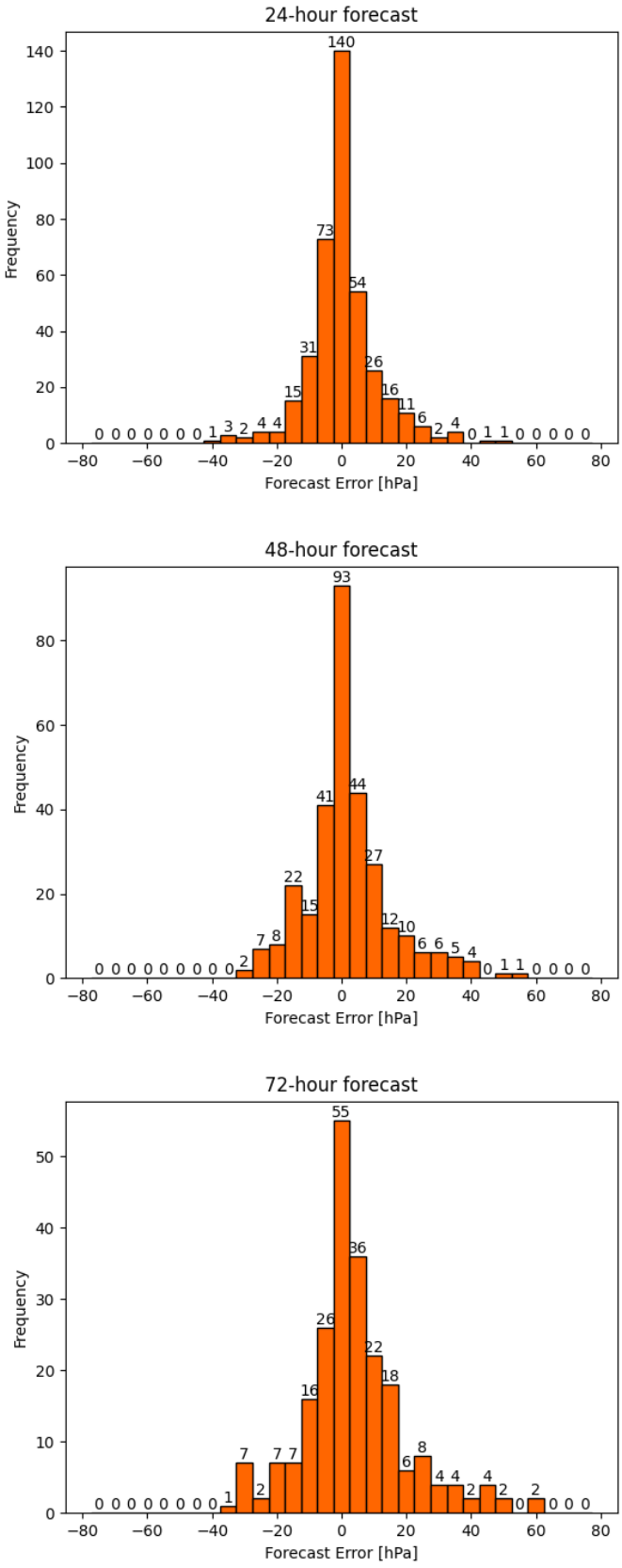


Figure A5.5 Histograms of RSMC 24-, 48- and 72-hour pressure forecast errors

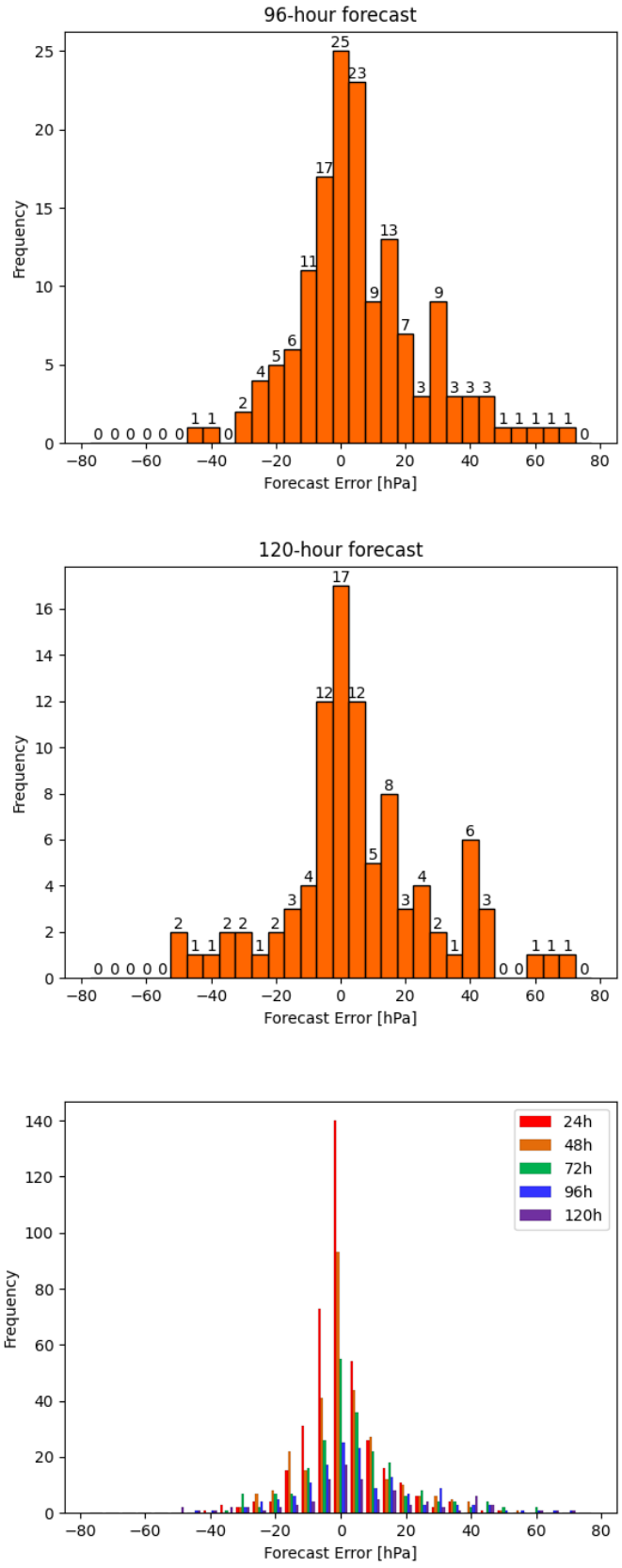


Figure A5.6 Histograms of RSMC 96-hour, 120-hour and all lead time pressure forecast errors

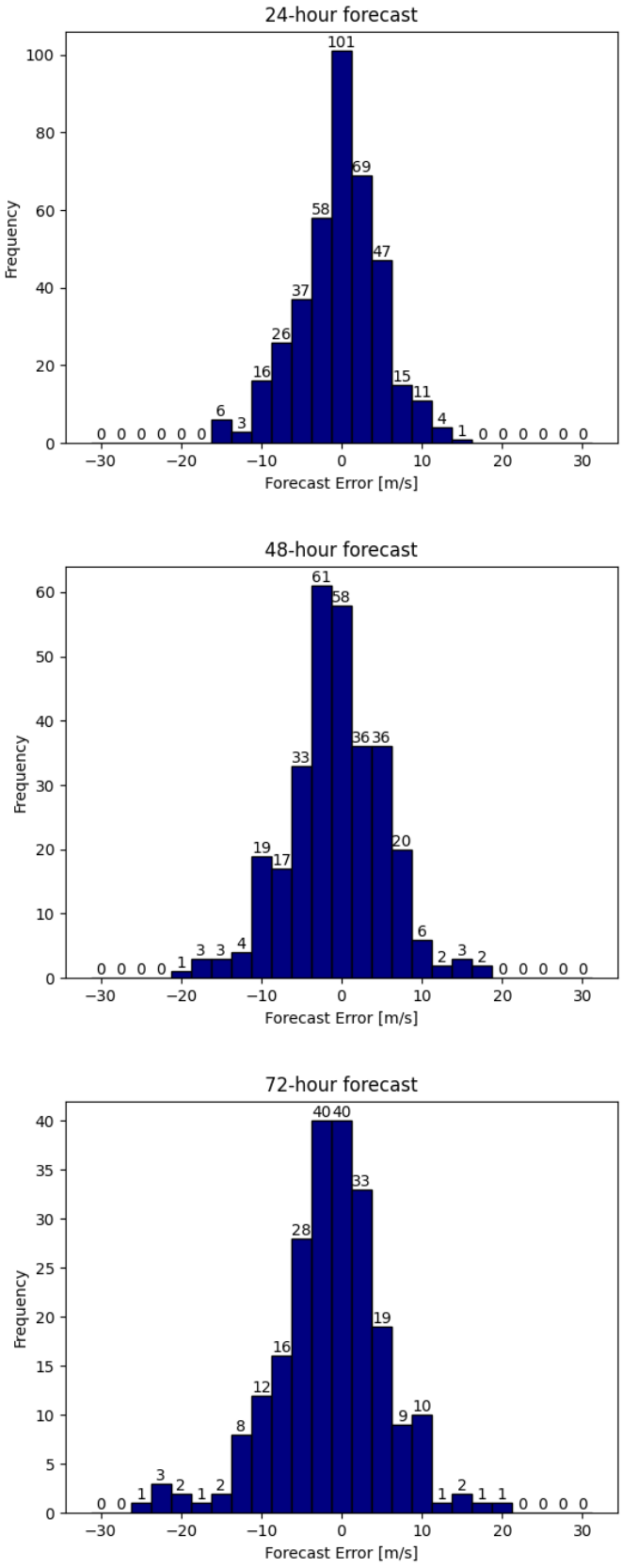


Figure A5.7 Histograms of RSMC 24-, 48- and 72-hour maximum wind speed forecast errors

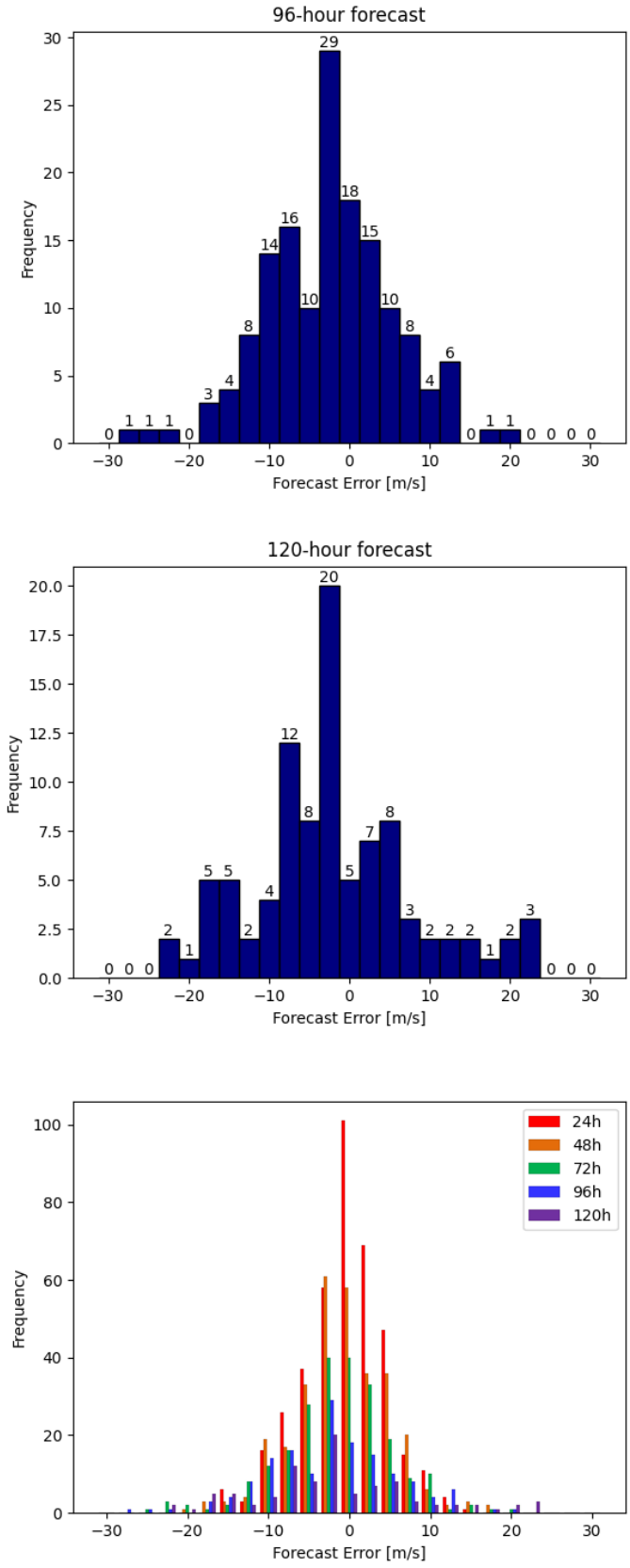


Figure A5.8 Histograms of RSMC 96-hour, 120-hour and all lead time maximum wind speed forecast errors

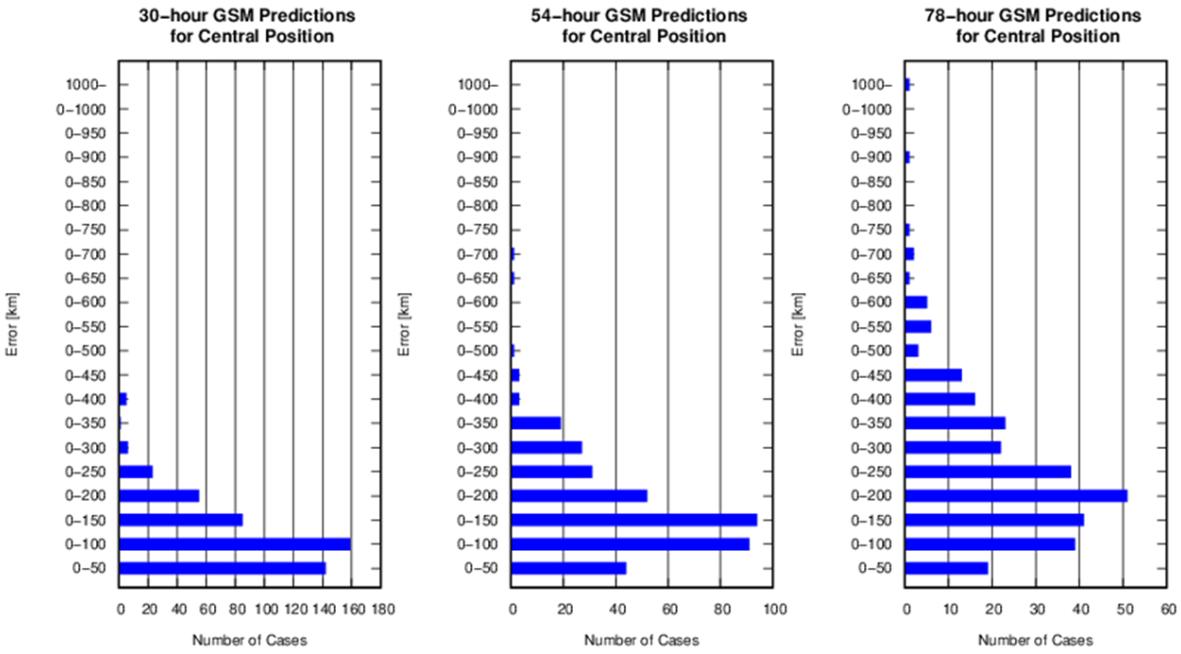


Figure A5.9 Histograms of GSM position errors for 30-, 54-, and 78-hour prediction

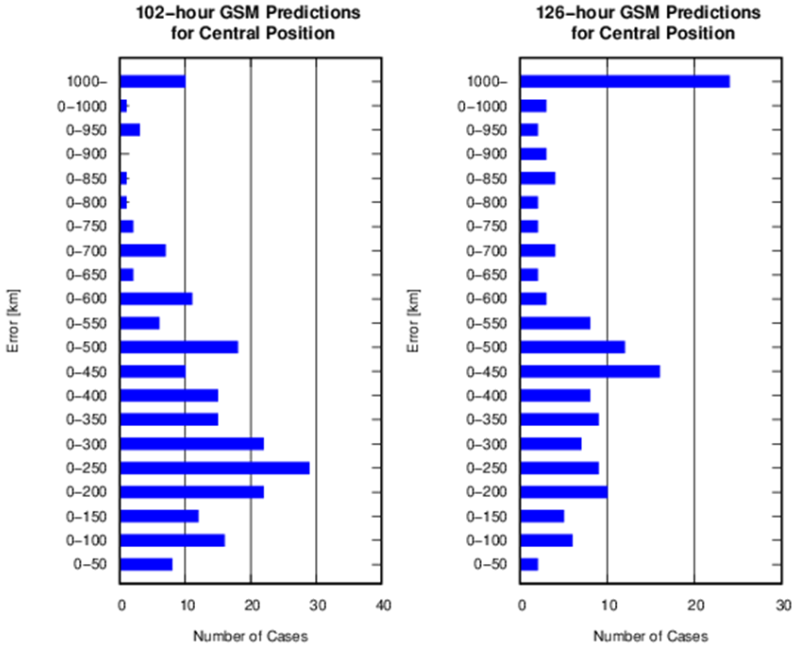


Figure A5.10 Histograms of GSM position errors for 102- and 126-hour prediction

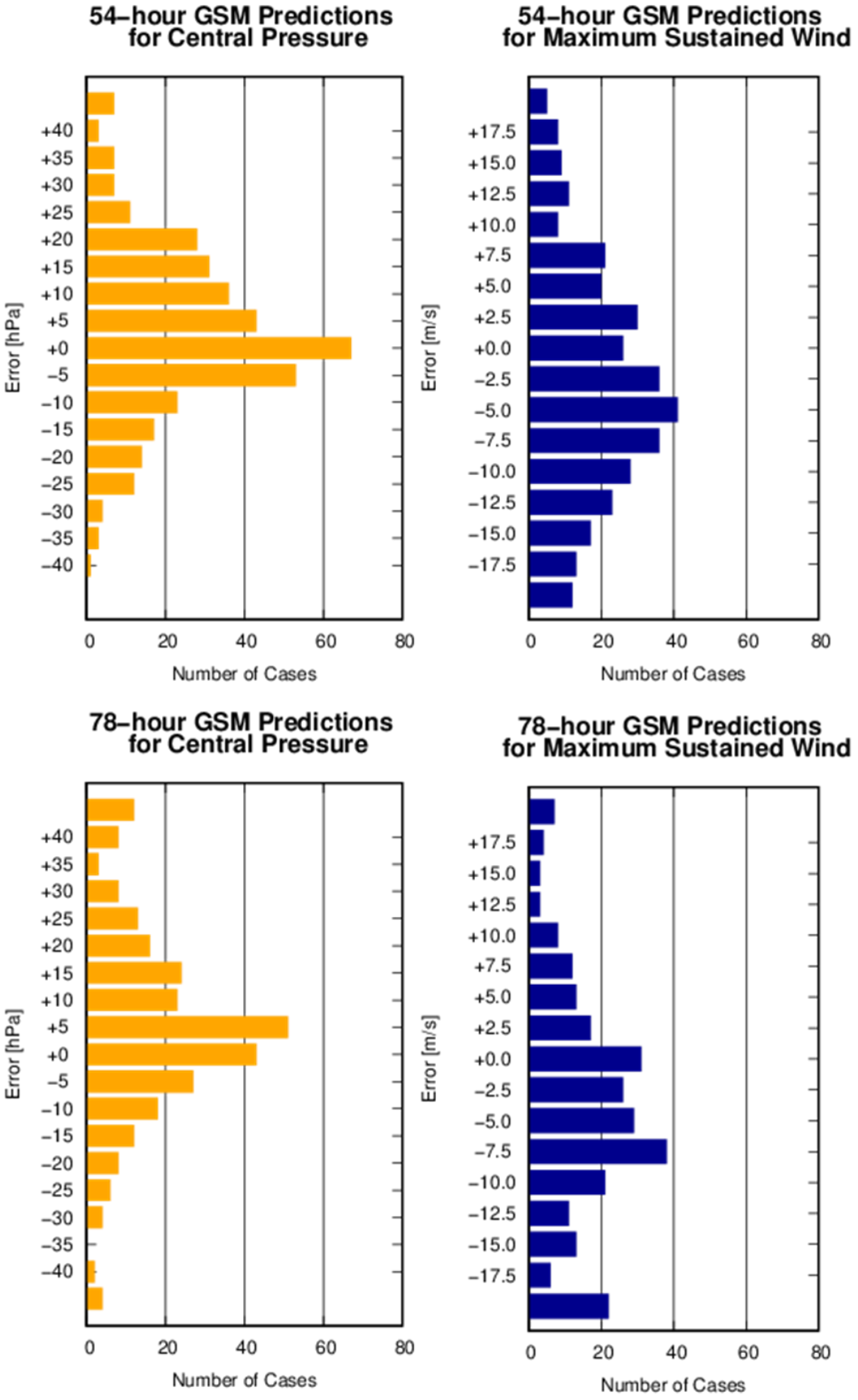


Figure A5.11 Histograms of GSM intensity errors for (top) 54- and (bottom) 78-hour prediction

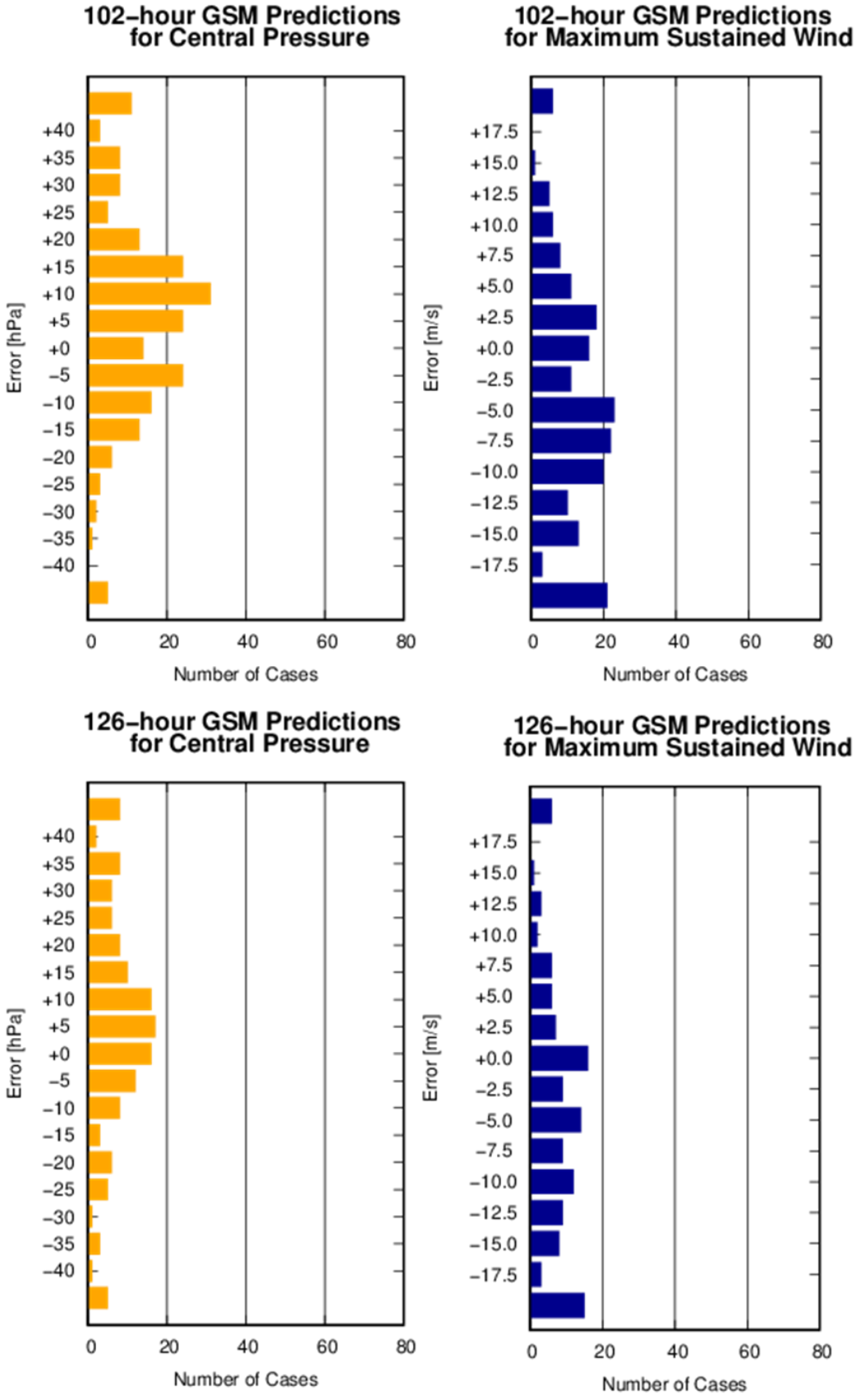


Figure A5.12 Histograms of GSM intensity errors for (top) 102- and (bottom) 126-hour prediction

Appendix 6
Code Forms of RSMC Products

(1) RSMC Tropical Cyclone Advisory (WTPQ50-55 RJTD)

WTPQii 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
Ft1Ft1HF 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
Ft2Ft2HF 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
Ft3Ft3HF 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
Ft4Ft4Ft4HF 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=

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)
Ft3Ft3	:	96 (00, 06, 12 and 18 UTC) or 93 (03, 09, 15 and 21 UTC)
Ft4Ft4 Ft4	:	120 (00, 06, 12 and 18 UTC) or 117 (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:

WTPQ50 RJTD 080000
RSMC TROPICAL CYCLONE ADVISORY
NAME TY 1919 HAGIBIS (1919)
ANALYSIS
PSTN 080000UTC 16.9N 143.8E GOOD
MOVE WNW 13KT
PRES 915HPA
MXWD 105KT
GUST 150KT
50KT 100NM
30KT 350NM EAST 240NM WEST
FORECAST
24HF 090000UTC 19.8N 140.0E 60NM 70%
MOVE NW 10KT
PRES 915HPA
MXWD 105KT
GUST 150KT
48HF 100000UTC 22.8N 138.4E 90NM 70%
MOVE NNW 08KT
PRES 915HPA
MXWD 105KT
GUST 150KT
72HF 110000UTC 26.5N 136.3E 120NM 70%
MOVE NNW 10KT
PRES 925HPA
MXWD 100KT
GUST 140KT
96HF 120000UTC 31.6N 135.9E 170NM 70%
MOVE N 13KT
PRES 940HPA
MXWD 090KT
GUST 130KT
120HF 130000UTC 37.5N 142.5E 240NM 70%
MOVE NE 20KT
PRES 980HPA
MXWD 060KT
GUST 085KT =

(2) RSMC Guidance for Forecast by GSM (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=006 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
T=012 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
T=018 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
:
T=132 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=006 15.4N 125.8E +018HPA -008KT
T=012 15.5N 125.6E +011HPA -011KT
T=018 15.8N 125.7E +027HPA -028KT
:
:
T=132 20.7N 128.8E +021HPA -022KT=

(3) RSMC Guidance for Forecast by GEPS (FXPQ30-35 RJTD)

FXPQii 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 ENSEMBLE PREDICTION SYSTEM
TIME PSTN PRES MXWD
(CHANGE FROM T=0)
T=006 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
T=012 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
T=018 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT
:
T=132 LaLa.La N LoLoLo.Lo E (or W) appp HPA awww KT=

Notes:

a. Underlined parts are fixed.

b. Symbolic letters

ii	:	'30', '31', '32', '33', '34' or '35'
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:

FXPQ30 RJTD 231200
RSMC GUIDANCE FOR FORECAST
NAME TY 1826 YUTU (1826)
PSTN 231200UTC 12.0N 149.6E
PRES 965HPA
MXWD 75KT
FORECAST BY GLOBAL ENSEMBLE PREDICTION SYSTEM
TIME PSTN PRES MXWD
(CHANGE FROM T=0)
T=006 12.7N 149.1E -002HPA +001KT
T=012 13.2N 148.3E -001HPA +004KT
T=018 13.8N 147.6E -005HPA +004KT
:
:
T=132 18.0N 129.9E -033HPA +030KT=

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

Example:

WTPQ30 RJTD 231200
RSMC TROPICAL CYCLONE PROGNOSTIC REASONING
REASONING NO.10 FOR TY 1826 YUTU (1826)
1.GENERAL COMMENTS
TY YUTU IS LOCATED AT 12.0N, 149.6E. INFORMATION ON THE CURRENT POSITION IS BASED ON ANIMATED MSI. POSITIONAL ACCURACY IS GOOD. THE SYSTEM IS IN A FAVORABLE ENVIRONMENT FOR DEVELOPMENT UNDER THE INFLUENCE OF HIGH SSTS, HIGH TCHP AND WEAK VWS. THIS HAS CAUSED THE SYSTEM TO DEVELOP OVER THE LAST SIX HOURS. HOWEVER, THE INFLUENCE OF DRY AIR IS UNFAVORABLE FOR SYSTEM DEVELOPMENT. INFORMATION ON CURRENT INTENSITY IS BASED ON DVORAK INTENSITY ANALYSES.
2.SYNOPTIC SITUATION
THE SYSTEM IS MOVING WESTWARD ALONG THE SOUTHERN PERIPHERY OF A MID-LEVEL SUB-TROPICAL HIGH. ANIMATED MSI SHOWS THE APPEARANCE OF AN EYE. WATER VAPOR IMAGERY SHOWS DRY AIR IN THE DIRECTION OF THE MOVEMENT. DMSP-F18/SSMIS 89 GHZ MICROWAVE IMAGERY SHOWS THE SYSTEM HAS A BAND WITH CURVATURE INDICATING THE CSC.
3.TRACK FORECAST
THE SYSTEM WILL MOVE NORTHWESTWARD ALONG THE PERIPHERY OF A MID-LEVEL SUB-TROPICAL HIGH UNTIL FT12. THE SYSTEM WILL THEN MOVE WEST-NORTHWESTWARD ALONG THE PERIPHERY OF A MID-LEVEL SUB-TROPICAL HIGH UNTIL FT120. THE JMA TRACK FORECAST IS BASED ON GSM PREDICTIONS, AND REFERENCE TO OTHER NWP MODELS. JMA TRACK FORECAST CONFIDENCE IS FAIR UNTIL FT48 BUT LOW THEREAFTER DUE TO SIGNIFICANT DIFFERENCES AMONG NUMERICAL MODEL OUTPUTS.
4.INTENSITY FORECAST
THE SYSTEM WILL DEVELOP UNTIL FT48 DUE TO THE INFLUENCE OF INTERACTION WITH HIGH SSTS, HIGH TCHP, WEAK VWS AND GOOD UPPER LEVEL OUTFLOW. THE SYSTEM WILL THEN MAINTAIN ITS INTENSITY UNTIL FT72 DUE TO THE INFLUENCE OF INTERACTION WITH HIGH SSTS, HIGH TCHP AND DRY AIR. THE JMA INTENSITY FORECAST IS BASED ON GUIDANCE DATA. =

(5) 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=

(6) 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

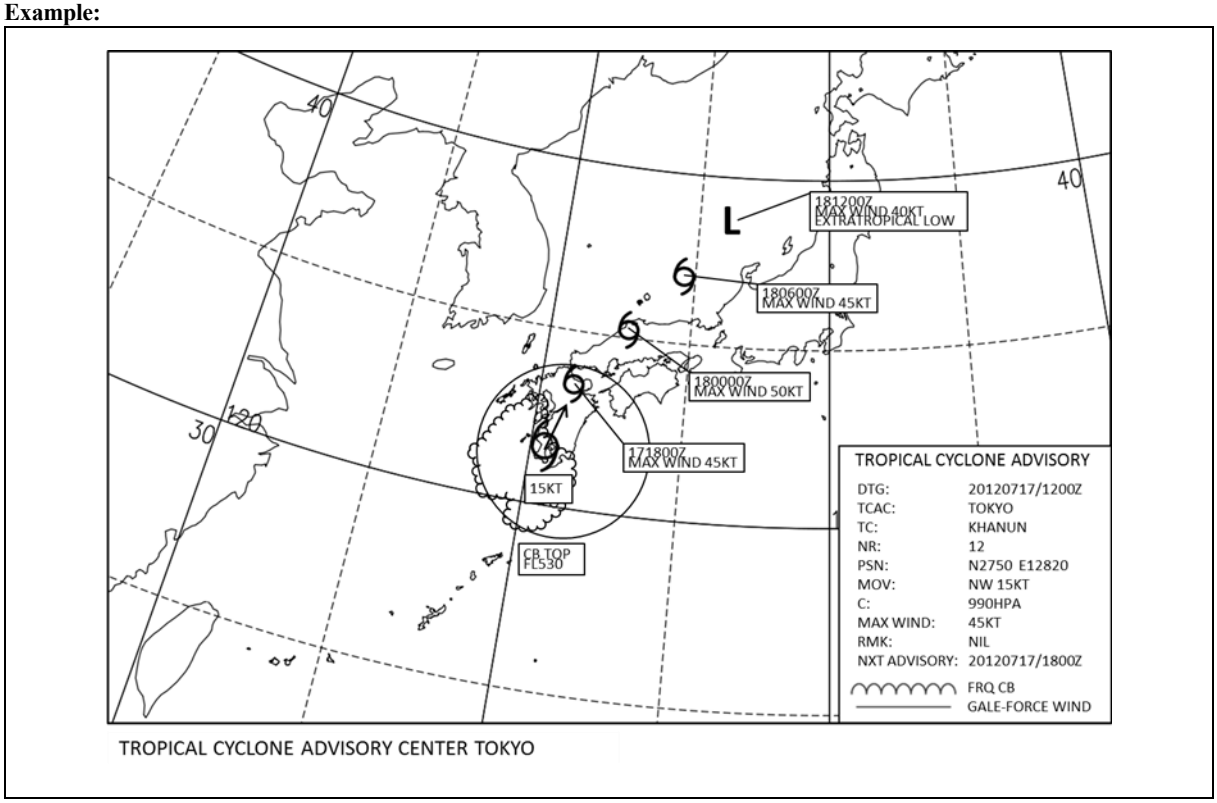
Example:

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 =

(7) Graphical Tropical Cyclone Advisory for SIGMET

Example:



Appendix 7
Specifications of JMA's NWP Models (GSM, GEPS)

The Global Spectral Model (GSM) and the Global Ensemble Prediction System (GEPS) are used in JMA as a primary basis for TC forecasts. The general specifications of GSM and GEPS are summarized in Table A7.1.

Table A7.1 Specifications of GSM and GEPS

NWP Models	GSM (Global Spectral Model), TQ959L128	GEPS (Global Ensemble Prediction System), TQ479L128
Resolution	13 km, 128 layers (Top: 0.01 hPa)	27 km, 128 layers (Top: 0.01 hPa)
Area	Global	Global
Method for initial value	Global Data Assimilation System (Hybrid-4DVAR) Outer resolution: TQ959L128 Inner resolution: TL319L128 Window: Init-3h to Init + 3h	Unperturbed condition: Truncated GSM initial condition Initial perturbation: LETKF-based perturbation and SV-based perturbation Ensemble size: 51 (50 perturbed members and 1 control member) SV target areas: Northern Hemisphere (30 – 90°N), Tropics (30°S – 30°N), Southern Hemisphere (90 – 30°S)
Forecast length (initial times)	264 hours (00, 12 UTC) 132 hours (06, 18 UTC)	432 hours (12 UTC) 264 hours (00, UTC) 132 hours (06, 18 UTC)
Operational as from	14 March 2023	14 March 2023

GSM (TQ959L128) has a horizontal resolution of approximately 13 km and 128 vertical layers. Details of the model can be found in JMA (2025) and Yonehara et al. (2023).

GEPS (TQ479L128) is an ensemble prediction system used for TC track forecasts up to five days ahead, one-week forecasts, early warning information on extreme weather, and one-month forecasts. It has 51 members and a horizontal resolution of approximately 27 km along with 128 vertical layers for the first 18 days of forecasts. Details of the system can be found in JMA (2025) and Ota et al. (2023). A combination of a Local Ensemble Transform Kalman Filter (LETKF; Hunt et al. 2007) and a singular vector (SV) method (Buizza and Palmer 1995) is employed for the initial perturbation setup. In addition, a stochastically perturbed physics tendency scheme (Buizza et al. 1999) is incorporated in consideration of model uncertainties associated with physical parameterizations, and a perturbation technique for sea surface temperature (SST) is incorporated to represent uncertainty in the prescribed SST.

[Recent upgrades to GSM, Global Data Assimilation System and GEPS]
Global Data Assimilation System:

- Assimilation of the ATMS and Cross-track Infrared Sounder (CrIS) data from NOAA-21 was started (March 2024)

[References]

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Hunt, B. R., E. J. Kostelich and I. Szunyogh, 2007: Efficient data assimilation for spatiotemporal chaos: a local ensemble transform Kalman filter. *Physica. D.*, **230**, 112 – 126.

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Ota, Y., J. Chiba, Y. Ichikawa, H. Oashi, T. Takakura and H. Yamaguchi, 2023: Upgrade of JMA's Global Ensemble Prediction System. *WGNE Res. Activ. Earth system Modell.*, **53**, 06.11-12.

Yonehara, H., Y. Kuroki, M. Ujiie, C. Matsukawa, T. Kanehama, R. Nagasawa, K. Ochi, M. Higuchi, Y. Ichikawa, R. Sekiguchi and S. Hirahara, 2023: Upgrade of JMA's Operational Global Numerical Weather Prediction System. *WGNE Res. Activ. Earth system Modell.*, **53**, 06.15-16.

Appendix 8
Products on WIS GISC Tokyo Server

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

NWP products (GSM and GEPS with GRIB formatted data)

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

Model	GEPS
Area and resolution	Whole globe, 2.5°×2.5°
Levels and elements	250 hPa: μU, σU, μV, σV 500 hPa: μZ, σZ 850 hPa: μU, σU, μV, σV, μT, σT 1000 hPa: μZ, σZ Surface: μP, σP
Forecast hours	0–192 every 12 hours
Initial times	00 and 12 UTC

NWP products (GSM and GEPS with GRIB2 formatted data)

Model	GSM	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°	Whole globe 1.25° × 1.25°
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	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, ζ, ∇ 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, ζ, ∇ 850 hPa: Z, U, V, T, H, ω, ψ, χ 925 hPa: Z, U, V, T, H, ω, ζ, ∇ 1000 hPa: Z, U, V, T, H, ω Surface: P, U, V, T, H, R
Forecast hours	0–132 every 3 hours 138–264 every 6 hours for 00 UTC and 12 UTC initial	0–132 every 3 hours 138–264 every 6 hours for 00 UTC and 12 UTC initial	0–132 every 3 hours 138–264 every 6 hours for 00 UTC and 12 UTC initial
Initial times	00, 06, 12 and 18 UTC	00, 06, 12 and 18 UTC	00, 06, 12 and 18 UTC

Model	GEPS
Area and resolution	Whole globe, 1.25°×1.25°
Levels and elements	250 hPa: μU, σU, μV, σV 500 hPa: μZ, σZ 850 hPa: μU, σU, μV, σV, μT, σT 1000 hPa: μZ, σZ Surface: μP, σP Probability of precipitation [1,5,10,25,50,100 mm/24hour], Probability of 10m sustained wind and gusts[10,15,25 m/s], Probability of temperature anomalies [±1, ±1.5, ±2σ]
Forecast hours	0-264 every 12 hours
Initial times	00 UTC and 12 UTC

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

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

Data	Contents / frequency (initial time)
Satellite products	High density atmospheric motion vectors (BUFR) Himawari-8/9 (VIS, IR, WVx3: every hour), 60S-60N, 90E-170W Clear Sky Radiance (CSR) data (BUFR) Himawari-8/9 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
SATAID service	(a) Satellite imagery (SATAID) Himawari-8/9 (b) Observation data (SATAID) SYNOP, SHIP, METAR, TEMP (A, B) and ASCAT sea-surface wind (c) NWP products (SATAID) GSM (Available at https://www.wis-jma.go.jp/cms/sataid/)

Appendix 9
Online RSMC Tokyo Products and Services

List of products provided on the Numerical Typhoon Prediction (NTP) website

Products	Frequency	Details
RSMC Advisories		
RSMC TC Advisory	At least 8 times/day	• The Center's TC analysis and forecasts up to 120 hours ahead (linked to the JMA website at https://www.jma.go.jp/bosai/map.html#contents=typhoon&lang=en)
Storm Wind Probability Map	4 times/day	• Probabilistic forecast map for sustained wind of 50-kt or more for 1, 2, 3, 4 and 5 days ahead
Prognostic Reasoning	4 times/day	• RSMC Tokyo Tropical Cyclone Prognostic Reasoning (WTPQ3X)
TC Advisory	4 times/day	• TC Advisory in text, graphical and xml formats including the Center's TC analysis, track and intensity forecasts up to 24-hours and horizontal extents of cumulonimbus cloud and cloud top height associated with TCs potentially affecting aviation safety (linked to the Tropical Cyclone Advisory Center Tokyo Website)
Remote Sensing		
Satellite Analysis	At least 4 times/day	• Results and historical logs of the Center's TC analysis conducted using satellite images (Conventional Dvorak analysis and Early-stage Dvorak analysis)
Satellite Imagery	Up to 142 times/day	• Satellite imagery of Himawari-8/9 (linked to the JMA website at https://www.jma.go.jp/bosai/map.html#elem=ir&lang=en&contents=himawari)
Satellite Microwave Products		• TC snapshot images • Warm-core-based TC intensity estimates • Weighted consensus TC intensity estimates made using Dvorak analysis and satellite microwave warm-core-based intensity estimates
Sea-surface AMV (ASWind)	Every 10 / 30 minutes	• AMV-based Sea-surface Wind in the vicinity of TC (linked to the Meteorological Satellite Center web site)
Radar Composite Imagery	Every hour	• Radar composite imagery of the Typhoon Committee Regional Radar Network
Atmospheric Circulation		
Weather Charts	4 times/day	• Weather maps for surface analysis, 24- and 48-hour forecasts (linked to the JMA website at https://www.jma.go.jp/bosai/weather_map/#lang=en)
NWP Multi Center Weather Charts	Twice/day	• Mean sea level pressure and 500 hPa Geopotential height (up to 168 hours) of deterministic NWP models from nine centers (BoM, CMA, CMC, DWD, ECMWF, KMA, NCEP, UKMO and JMA)
JMA GSM Analysis and Forecast	4 times/day	• Upper-air analysis and forecast data based on JMA-GSM - Streamlines at 850, 500 and 200 hPa - Divergence at 200 hPa - Velocity potential at 200 hPa - Vertical Velocity in Pressure Coordinate at 500 hPa - Dew Point Depression at 600 hPa - Curvature Vorticity at 850 hPa - Vertical wind shear between 200 and 850 hPa - Sea Level Pressure - Genesis Potential Index
MJO Phase Diagram	Daily	• MJO phase and amplitude diagram • MJO Hovmöller diagram (linked to the Tokyo Climate Center web site)

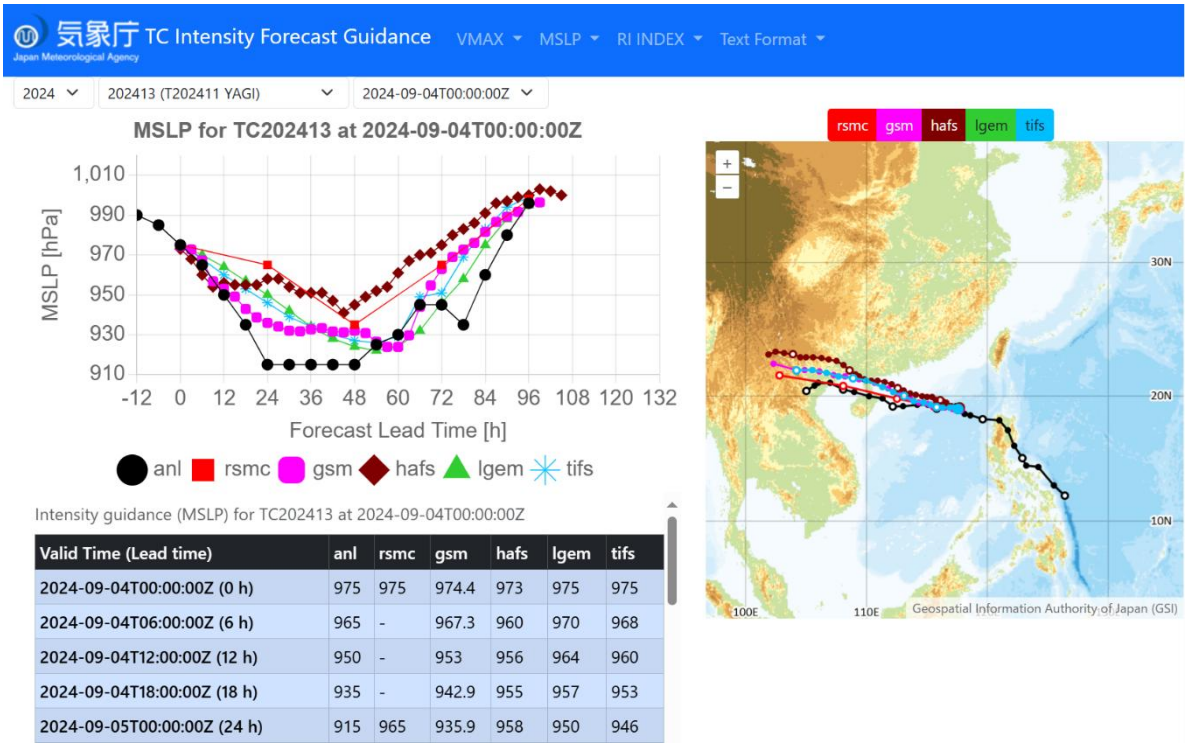
Products	Frequency	Details
Asian Monsoon Monitoring Indices	Daily, only during Apr. - Oct.	• Time series of vertical wind shear, OLR and other indices associated with SW Asian Monsoon (linked to the Tokyo Climate Center web site)
Ocean Condition		
SST	Once/day	• Sea surface temperature and related differences from 24 hours ago
TCHP	Once/day	• Tropical cyclone heat potential and related differences from 24 hours ago
Numerical TC Prediction		
Track Bulletin	4 times/day	• RSMC Tokyo Tropical Cyclone Track Forecast Bulletin - Track forecast by GSM (FXPQ2X) - Track forecast by GEPS (FXPQ3X)
TC intensity (TIFS monitor)	4 times/day	• TC Intensity prediction of TIFS, LGEM, HAFS and GSM
TC Track Prediction	4 times/day	• TC track prediction of deterministic NWP models from nine centers (BoM, CMA, CMC, DWD, ECMWF, KMA, NCEP, UKMO and JMA) • TC track prediction of EPS models from four centers (ECMWF, NCEP, UKMO and JMA)
TC Activity Prediction	Twice/day	• Two- and five-day TC activity prediction maps based on EPS models from four centers (ECMWF, UKMO, NCEP and JMA) and a related consensus
TC Verification	4 times/day	• Verification results of the Center's official forecasts as well as NWP model and guidance predictions.
Marine Forecast		
Storm Surge Forecasts	4 times/day	• Distribution of storm surge for the Center TC track forecasts and probabilistic products (ensemble mean, maximum, third quartile, spread and exceeding probabilities) of storm surge EPS from GEPS ensemble members (up to 132 hours) • Time-series storm surge forecast charts (plume diagrams, box plots and exceeding probabilities) for the Center TC track forecasts and 51 TC track forecasts from GEPS ensemble members (up to 132 hours)
Ocean Wave Forecasts	Twice/day	• Distribution maps for ensemble mean, maximum, probability of exceeding various thresholds and ensemble spread of wave height and period based on the Wave Ensemble System (WENS) (up to 264 hours) • Time-series representations with box-and-whisker plots for wave height/period and probability of exceeding various wave height/period thresholds based on WENS (up to 264 hours)

List of services provided on the TC communication platform

Services	Details
Early announcement[11]	• Announcement of "upgrade is being consideration" prior to Advance notice from the Center *Supplemental information to RSMC advisories (It may not be provided in certain situations and should not be considered as an official RSMC advisory and/or its replacement)
Advance notice	• Advance notice on TC status change from the Center *Supplemental information to RSMC advisories (It may not be provided in certain situations and should not be considered as an official RSMC advisory and/or its replacement)
Enhanced communication	• A platform on which Committee Members can post inquiries or comments related to tropical cyclone analysis and forecasts

[11] This service started in 2025.

RSMC Tokyo – Typhoon Center product examples

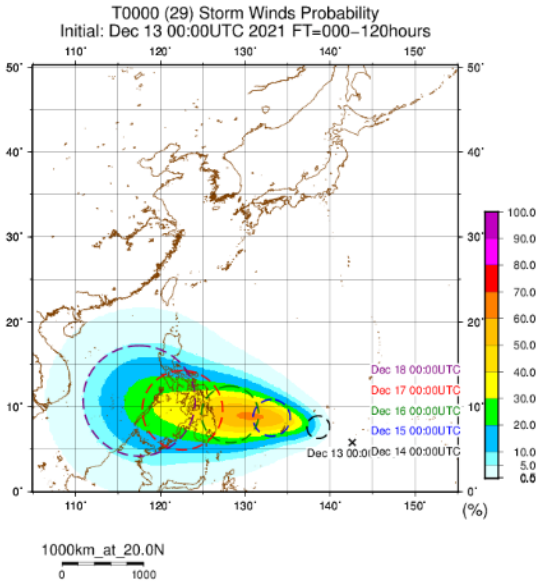


Intensity guidance (MSLP) for TC202413 at 2024-09-04T00:00:00Z

Valid Time (Lead time)	anl	rsmc	gsm	hafs	lgem	tifs
2024-09-04T00:00:00Z (0 h)	975	975	974.4	973	975	975
2024-09-04T06:00:00Z (6 h)	965	-	967.3	960	970	968
2024-09-04T12:00:00Z (12 h)	950	-	953	956	964	960
2024-09-04T18:00:00Z (18 h)	935	-	942.9	955	957	953
2024-09-05T00:00:00Z (24 h)	915	965	935.9	958	950	946

Website on the TIFS (Typhoon Intensity Forecast scheme based on SHIPS) monitor

The upper figure shows TIFS, LGEM, HAFS and GSM intensity prediction values at each initial time for individual TCs with analysis data in line graphs as well as a map of tracks. The table shows intensity prediction values at each valid time with analysis data.



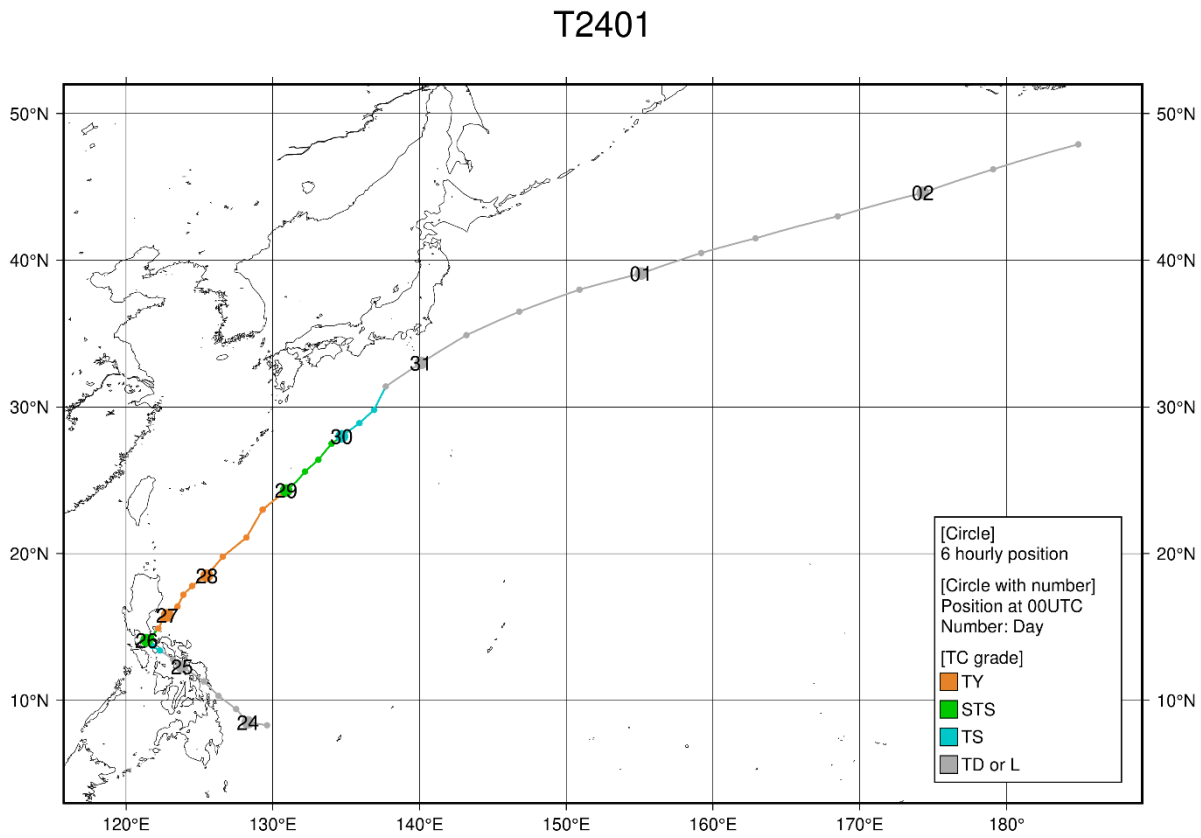
Five-day storm wind probability product (50 kt and above)

The figure shows spatial distribution of accumulated probability for the storm wind (equal to or above 50 kt) area associated with a selected TC up to a selected lead time on the calibrated levels of moderate (yellow), middle (red) and high (violet).

Appendix 10
Tropical Cyclones in 2024

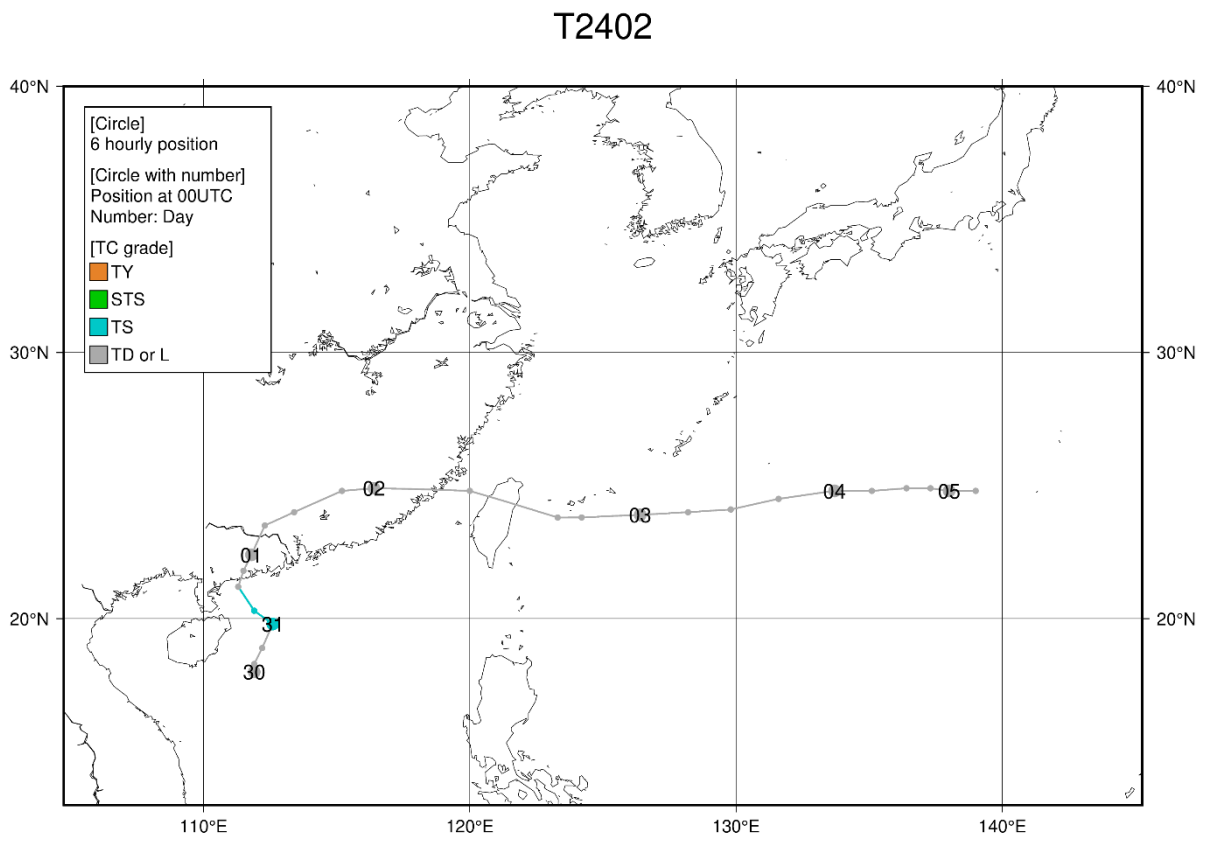
EWINIAR (2401)

EWINIAR formed as a tropical depression (TD) over the sea east of Mindanao at 18 UTC on 23 May 2024 and moved northwestward. It was upgraded to tropical storm (TS) intensity over the Philippines at 12 UTC on 25 May. It was further upgraded to severe tropical storm (STS) intensity in Luzon Island at 00 UTC on 26 May. After turning northeastward, it was upgraded to typhoon (TY) intensity over the Philippines 12 hours later. It reached its peak intensity with maximum sustained winds of 75 kt and a central pressure of 970 hPa over the same waters at 00 UTC on 27 May. It downgraded to STS intensity over the sea south of Japan at 00 UTC on 29 May and weakened to TS intensity at 00 UTC the next day. Keeping its northeastward track, it transitioned into an extratropical cyclone over the same waters 18 hours later. Further accelerating east-northeastward, it entered the sea south of the Aleutian Islands and crossed longitude 180 degrees east before 12 UTC on 2 June.



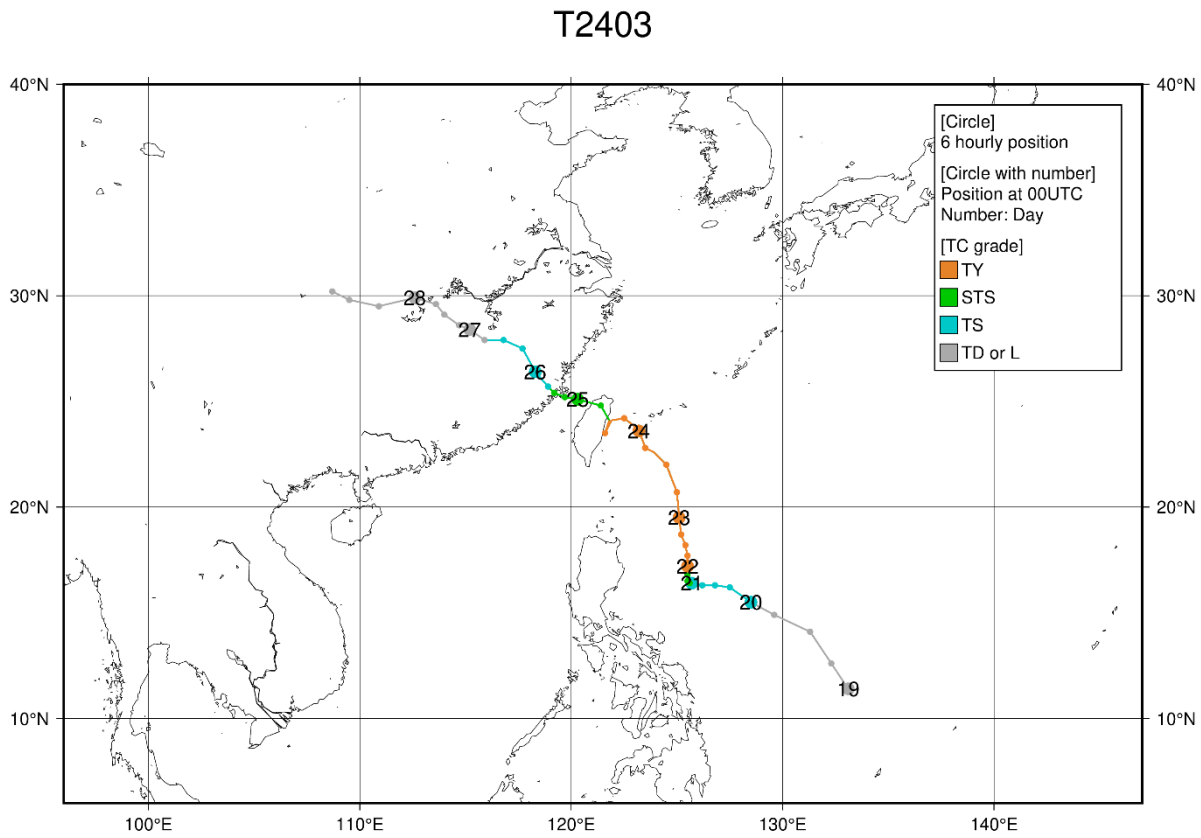
MALIKSI (2402)

MALIKSI formed as a tropical depression (TD) over the South China Sea at 00 UTC on 30 May 2024 and moved northeastward. It was upgraded to tropical storm (TS) intensity, reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 998 hPa over the same waters at 00 UTC on 31 May and moved northwestward. It weakened to TD intensity over the same waters 12 hours later and then hit South China while moving northeastward. Moving eastward, it transitioned into an extratropical cyclone by 00 UTC on 2 June and then entered the East China Sea. Keeping its eastward track, it dissipated over the sea south of Japan at 12 UTC on 5 June.



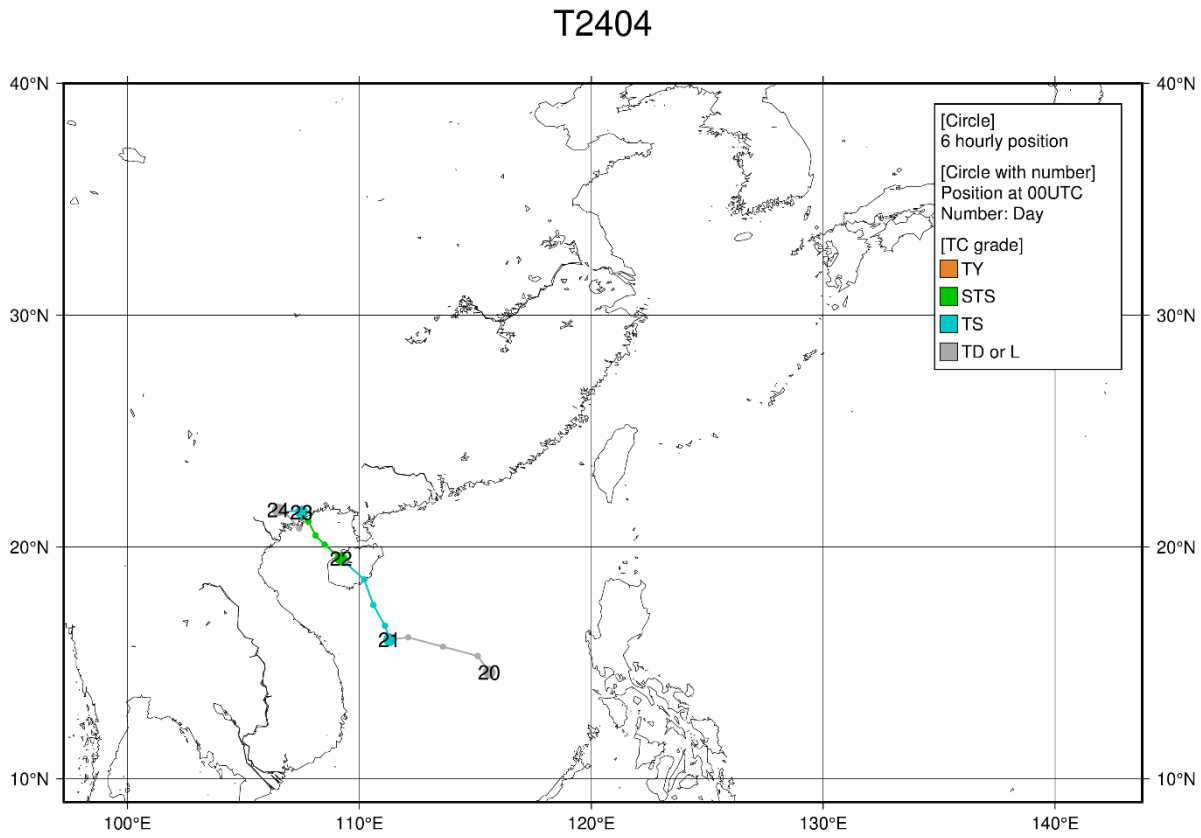
GAEMI (2403)

GAEMI formed as a tropical depression (TD) over the sea east of the Philippines at 00 UTC on 19 July 2024 and moved northwestward. It was upgraded to tropical storm (TS) intensity over the same waters at 00 UTC the next day and moved westward. After turning northward, it was further upgraded to typhoon (TY) intensity over the same waters at 00 UTC on 22 July. It moved westward and reached its peak intensity with maximum sustained winds of 90 kt and a central pressure of 935 hPa south of Yonagunijima Island at 03 UTC on 24 July. Turning in a counterclockwise direction to circle over the sea east of Taiwan, it was downgraded to STS intensity at 15 UTC the same day. Moving westward, it hit Taiwan with STS intensity after 15UTC the same day and weakened rapidly. After passing through Taiwan Strait, it hit South China with STS intensity at 12 UTC on 25 July and downgraded to TS intensity in same area at 18 UTC the same day. Moving northwest-westward, it weakened to TD intensity in Central China at 18 UTC on 26 July and then dissipated at 00UTC on 29 July.



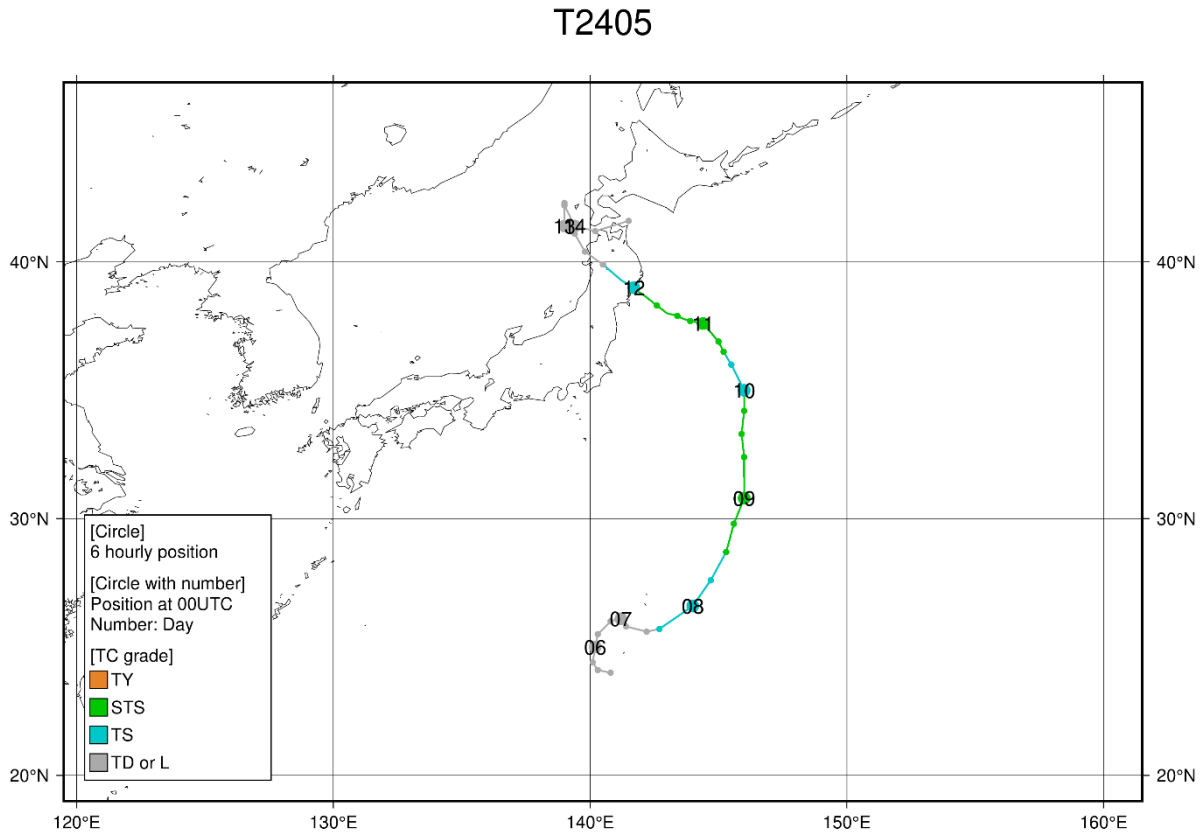
PRAPIROON (2404)

PRAPIROON formed as a tropical depression (TD) over the South China Sea at 00 UTC on 20 July 2024 and moved northwestward, then west-northwestward. It was upgraded to tropical storm (TS) intensity at 00 UTC the next day over the same waters and moved north-northwestward. It crossed Hainan Island with TS intensity around 18 UTC on 21 July and was upgraded to severe tropical storm (STS) intensity six hours later. After entering the Gulf of Tonkin, it reached its peak intensity with maximum sustained winds of 55 kt and a central pressure of 985 hPa at 06 UTC on 22 July. It hit Viet Nam before 00 UTC on 23 July, weakened to TD intensity 12 hours later and then moved westward. After turning in a clockwise direction to circle, it entered the Gulf of Tonkin by 00UTC on 25 July again and then dissipated.



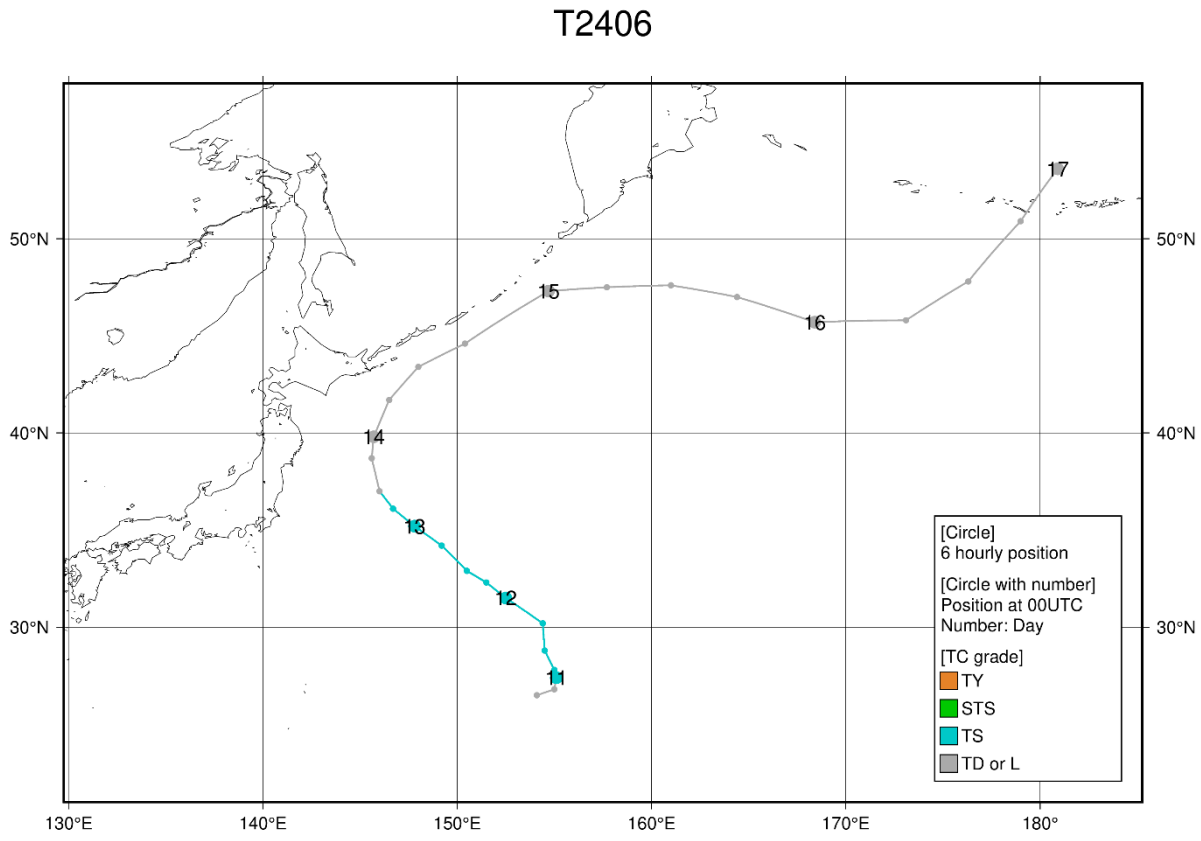
MARIA (2405)

MARIA formed as a tropical depression (TD) over the sea around the Ogasawara Islands at 06 UTC on 5 August 2024 and moved northwestward. After it gradually turned eastward, it was upgraded to tropical storm (TS) intensity over the same waters at 18 UTC on 7 August and moved northeastward. It was further upgraded to severe tropical storm (STS) intensity at 12 UTC the next day and reached its peak intensity with maximum sustained winds of 55 kt and a central pressure of 980 hPa over the same waters six hours later, as moving northward. After it gradually turned northwestward, it made landfall near Ofunato city, Iwate Prefecture with STS intensity around 2330 UTC on 11 August. Crossing Honshu Island, it weakened to TD intensity at 06 UTC the next day and then entered the Sea of Japan. It slowly moved northward, passed through the Tsugaru Strait and dissipated over the waters south of Hokkaido Island at 18 UTC on 14 August.



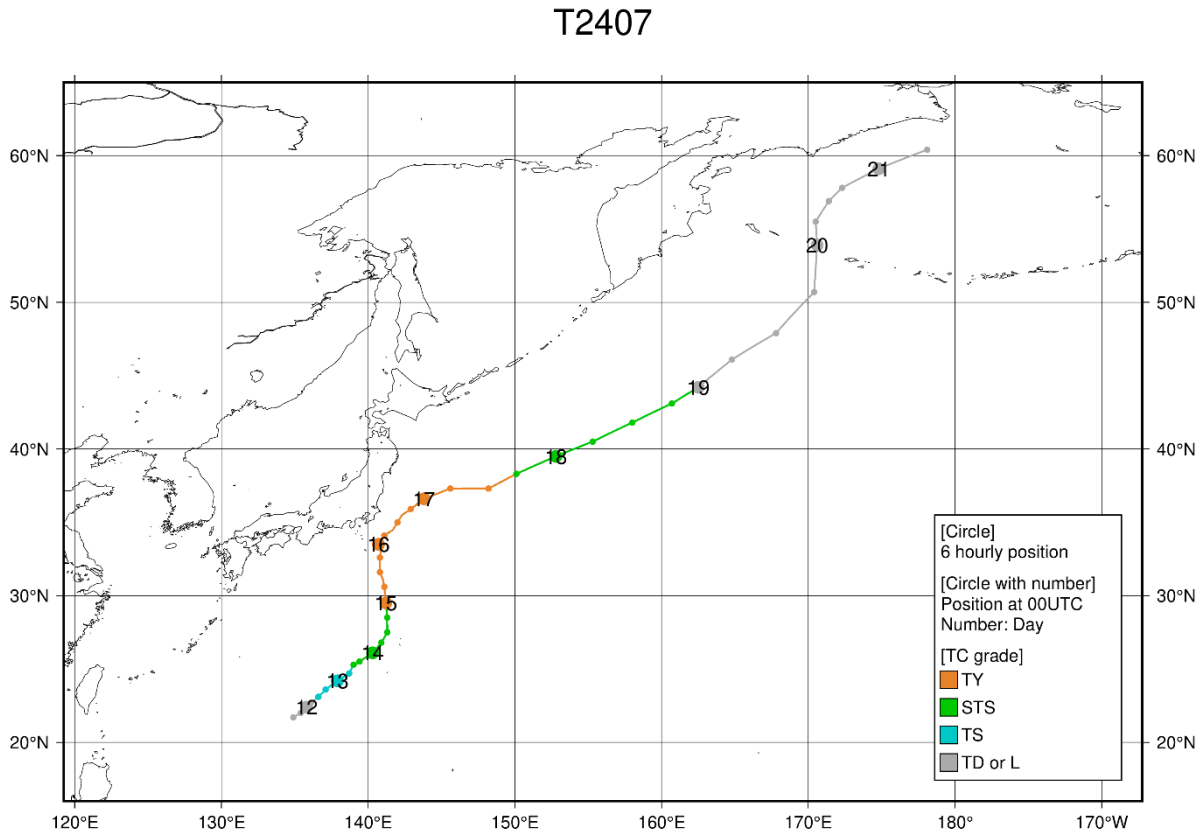
SON-TINH (2406)

SON-TINH formed as a tropical depression (TD) over the sea north of Minamitorishima Island at 12 UTC on 10 August 2024 and moved 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 40 kt and a central pressure of 994 hPa over the same waters 12 hours later, as moving northwestward. It weakened to TD intensity over the sea east of Japan at 12 UTC on 13 August and gradually accelerated northeastward. Maintaining its northeastward track, it transformed into an extratropical cyclone over the sea around the Kuril Islands by 00 UTC on 15 August and then turned eastward. After it turned northeastward toward the sea around the Aleutian Islands, it crossed longitude 180 degrees east before 00 UTC on 17 August.



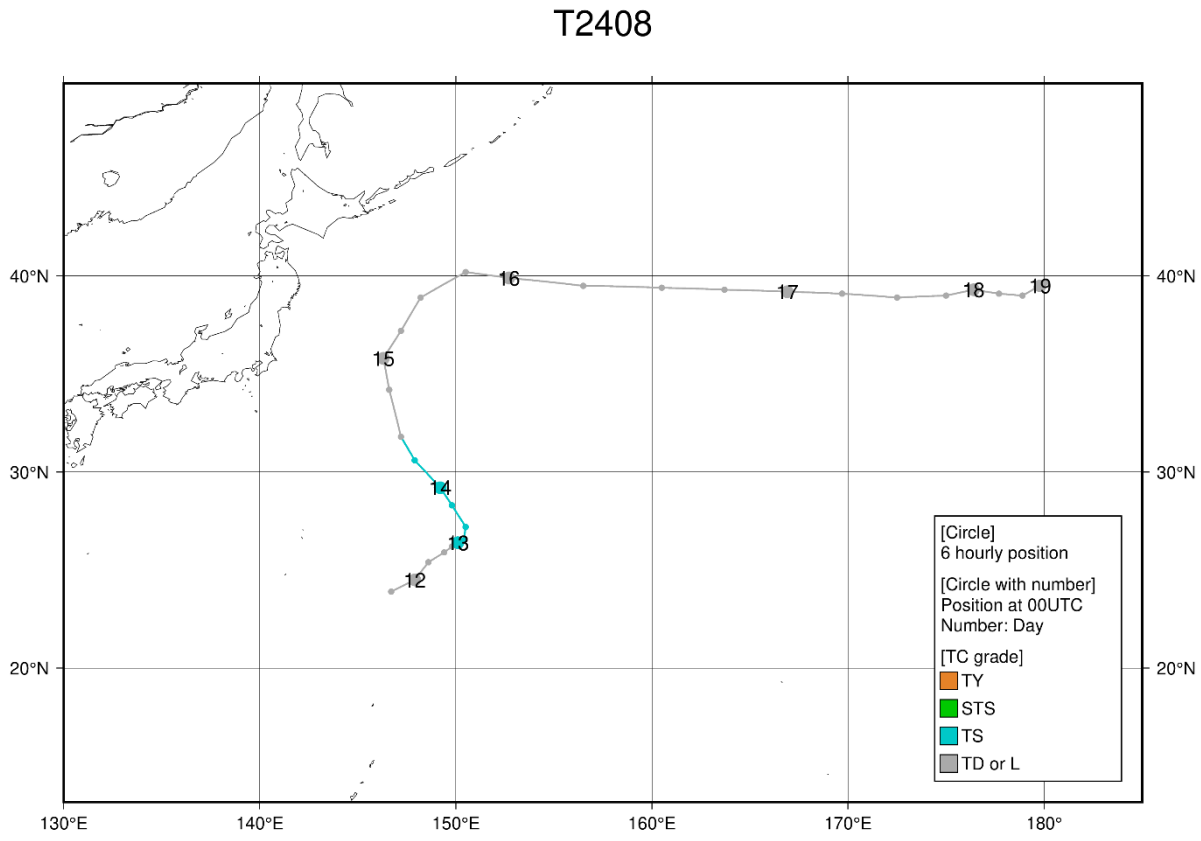
AMPIL (2407)

AMPIL formed as a tropical depression (TD) over the sea south of Japan at 12 UTC on 11 August 2024 and moved northeastward. It was upgraded to tropical storm (TS) intensity over the same waters at 12 UTC on 12 August. After turning northward, it was further upgraded to typhoon (TY) intensity over the sea around the Ogasawara Islands at 00 UTC on 15 August. Keeping its northward track, it reached its peak intensity with maximum sustained winds of 85 kt and a central pressure of 950 hPa over the sea east of Japan 12 hours later. Moving northeastward, it was downgraded to severe tropical storm (STS) intensity over the same waters at 18 UTC on 17 August and transitioned into an extratropical cyclone over the sea east of the Kuril Islands by 00 UTC on 19 August. After moving northward and entering the Bering Sea, it turned northeastward and then crossed latitude 60 degrees north before 06 UTC on 21 August.



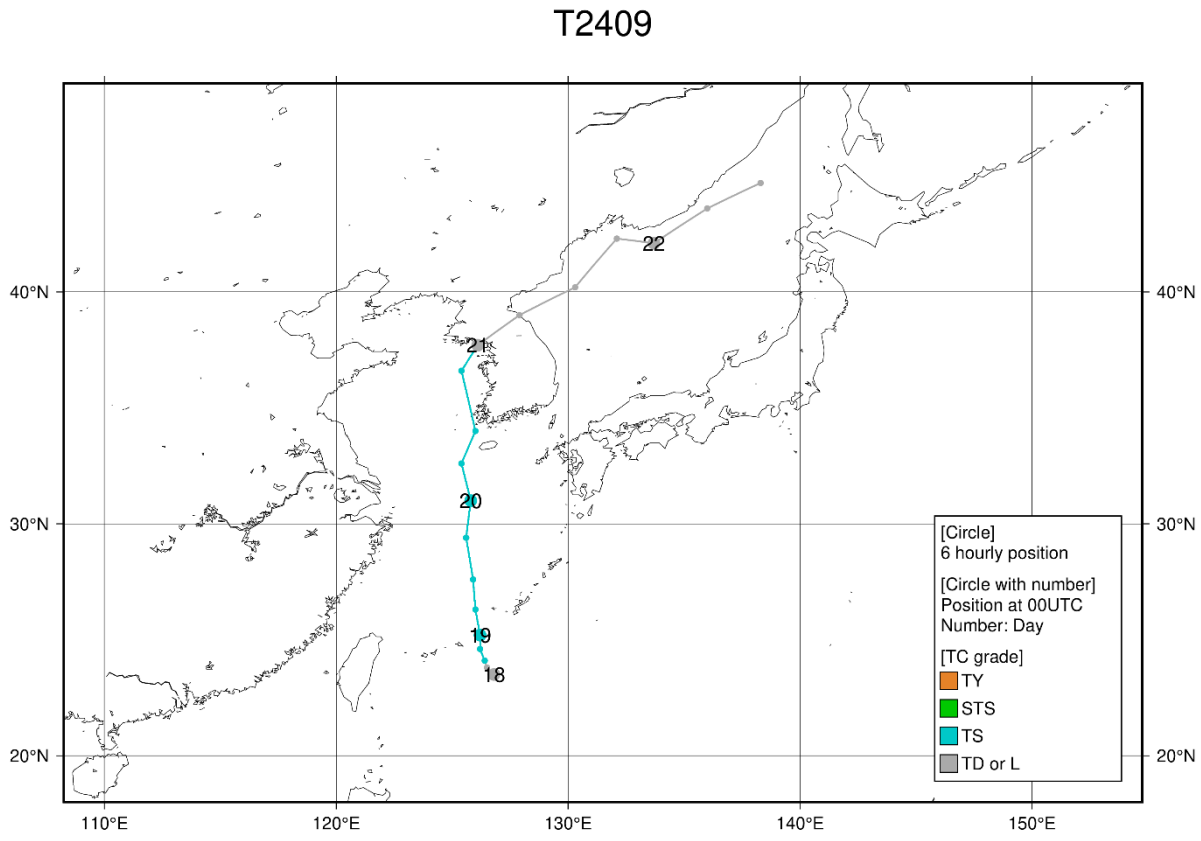
WUKONG (2408)

WUKONG formed as a tropical depression (TD) over the sea east of the Ogasawara Islands at 18 UTC on 11 August 2024 and moved northeastward. 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 1002 hPa over the sea northwest of Minamitorishima Island at 00 UTC on 13 August. After it turned northwestward, it weakened to TD intensity over the sea east of Japan at 12 UTC on 14 August and gradually turned eastward. Maintaining its eastward track, it transformed into an extratropical cyclone over the sea far off east of Japan by 12 UTC on 16 August. After entering the sea south of Aleutians, it crossed longitude 180 degrees east before 06 UTC on 19 August.



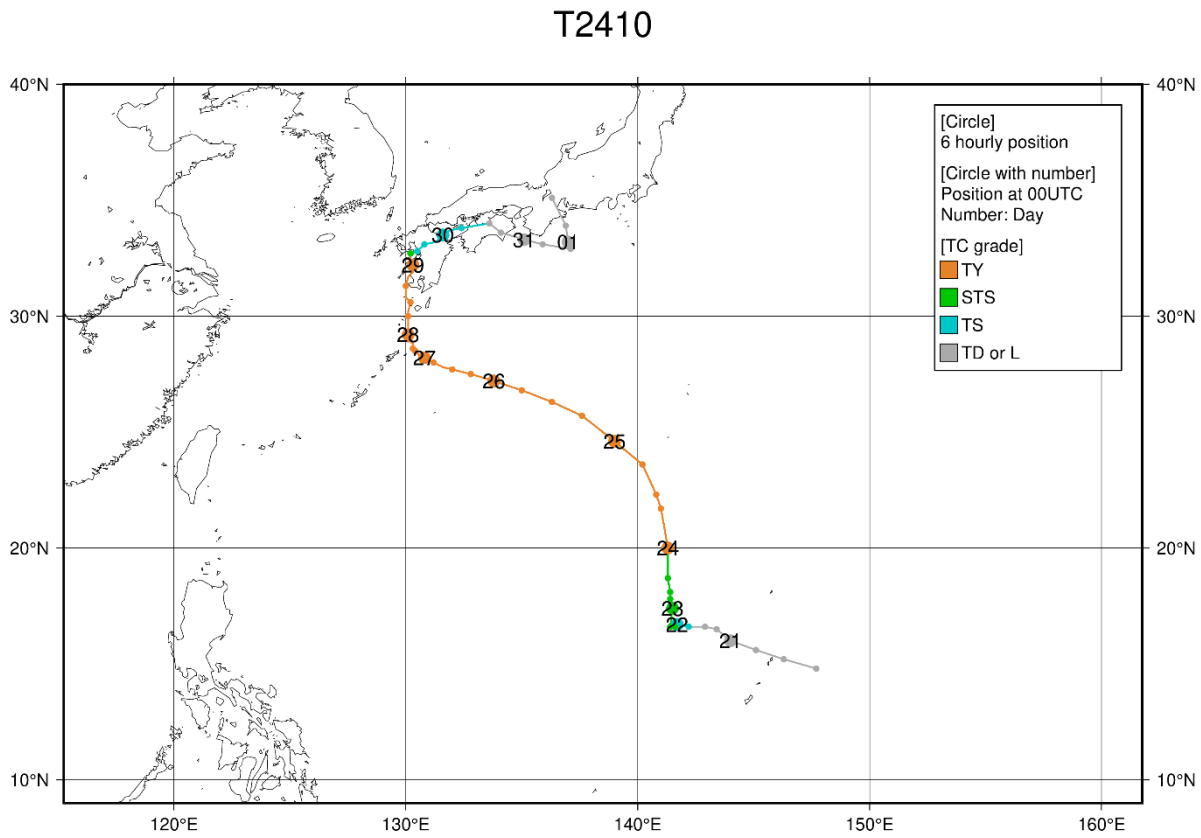
JONGDARI (2409)

JONGDARI formed as a tropical depression (TD) over the sea south of Okinawa at 00 UTC on 18 August 2024 and moved northward. It was upgraded to tropical storm (TS) intensity over the same waters 12 hours later. Keeping its northward track and moving to the East China Sea, it reached its peak intensity with maximum sustained winds of 40 kt and a central pressure of 996 hPa over the same waters at 06 UTC on 19 August. It entered the Yellow Sea, turned northeastward and then weakened to TD intensity over the waters near the western coast of the Korean Peninsula at 00 UTC on 21 August. After crossing the Korean Peninsula and entering the Sea of Japan, it transitioned into an extratropical cyclone by 00 UTC on 22 August and dissipated over the same waters 18 hours later.



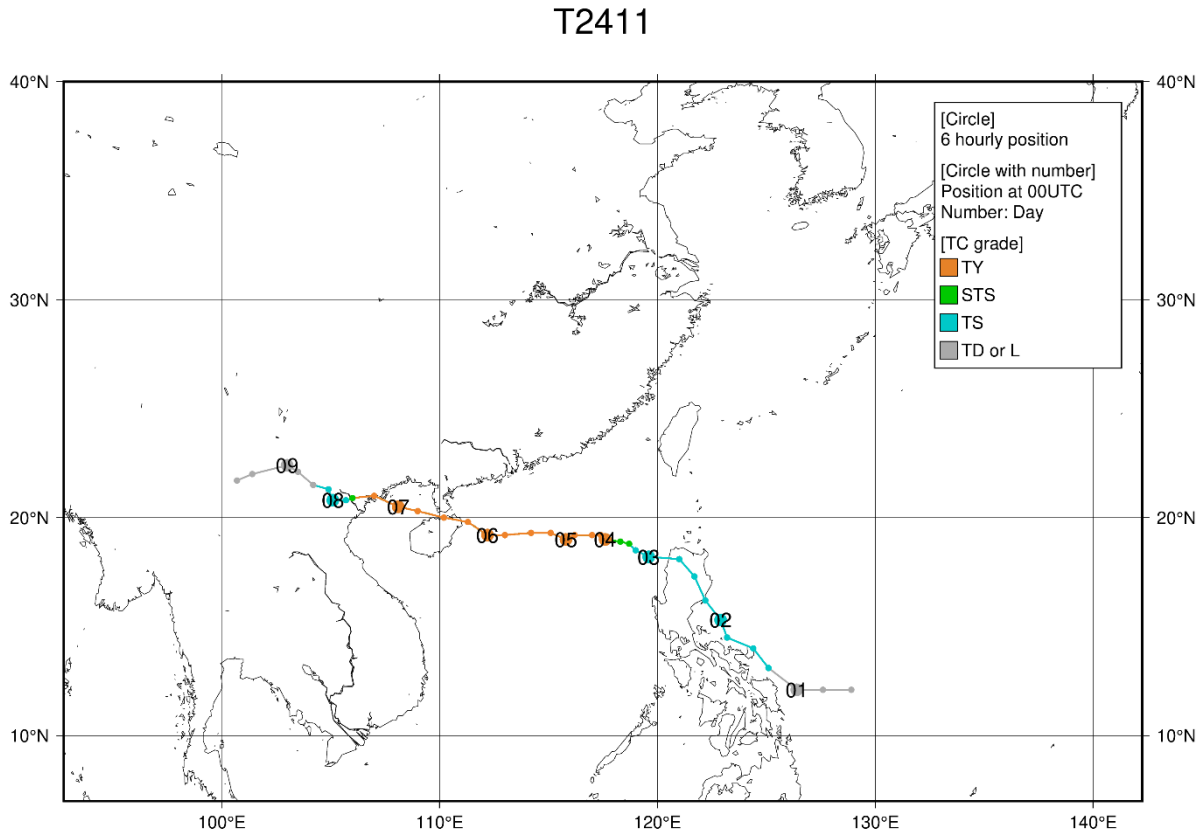
SHANSHAN (2410)

SHANSHAN formed as a tropical depression (TD) around the Mariana Islands at 06 UTC on 20 August 2024 and moved westward. It was upgraded to tropical storm (TS) intensity over the same waters at 18 UTC on 21 August. After turning sharply northward, it was further upgraded to typhoon (TY) intensity around the Ogasawara Islands at 00 UTC on 24 August. Turning northwestward, it reached its peak intensity with maximum sustained winds of 95 kt and a central pressure of 935 hPa northeast of Amami-Oshima Island at 15 UTC on 27 August. Moving northward and gradually turning northeastward, it made landfall near Satsumasendai city, Kagoshima Prefecture with TY intensity around 23 UTC on 28 August. After making landfall, it weakened rapidly and was downgraded to severe tropical storm (STS) intensity over Kyushu Island at 06 UTC on 29 August and to TS intensity six hours later. It moved eastward and then weakened to TD intensity over Shikoku Island at 12 UTC on 30 August. After moving to the sea south of Japan with its southeast track, it turned northward sharply and then dissipated in Honshu Island at 18 UTC on 1 September.



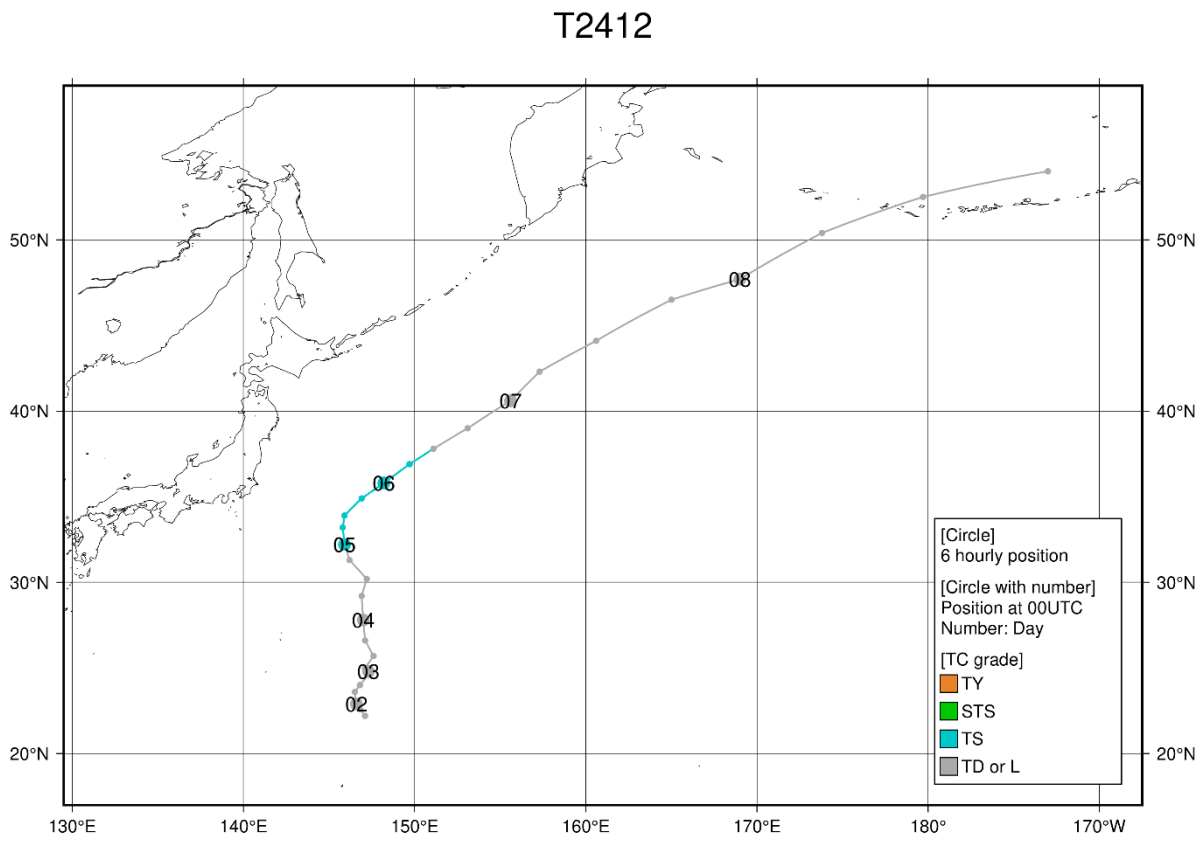
YAGI (2411)

YAGI formed as a tropical depression (TD) over the sea east of the Philippines at 12 UTC on 31 August 2024 and moved westward. Turning northwestward, it was upgraded to tropical storm (TS) intensity over the same waters at 06 UTC on 1 September. After crossing north of Luzon Island and turning westward, it was further upgraded to typhoon (TY) intensity over the South China Sea at 00 UTC on 4 September. It developed rapidly and reached its peak intensity with maximum sustained winds of 105 kt and a central pressure of 915 hPa over the same waters at 00 UTC on 5 September. After crossing Hainan Island, it entered the Gulf of Tonkin and hit Northern Viet Nam with TY intensity around 06 UTC on 7 September. As it moved westward in the area, it was downgraded to TS intensity 12 hours later and weakened to TD intensity at 12 UTC on 8 September. It dissipated in Southwestern China at 18 UTC on 9 September.



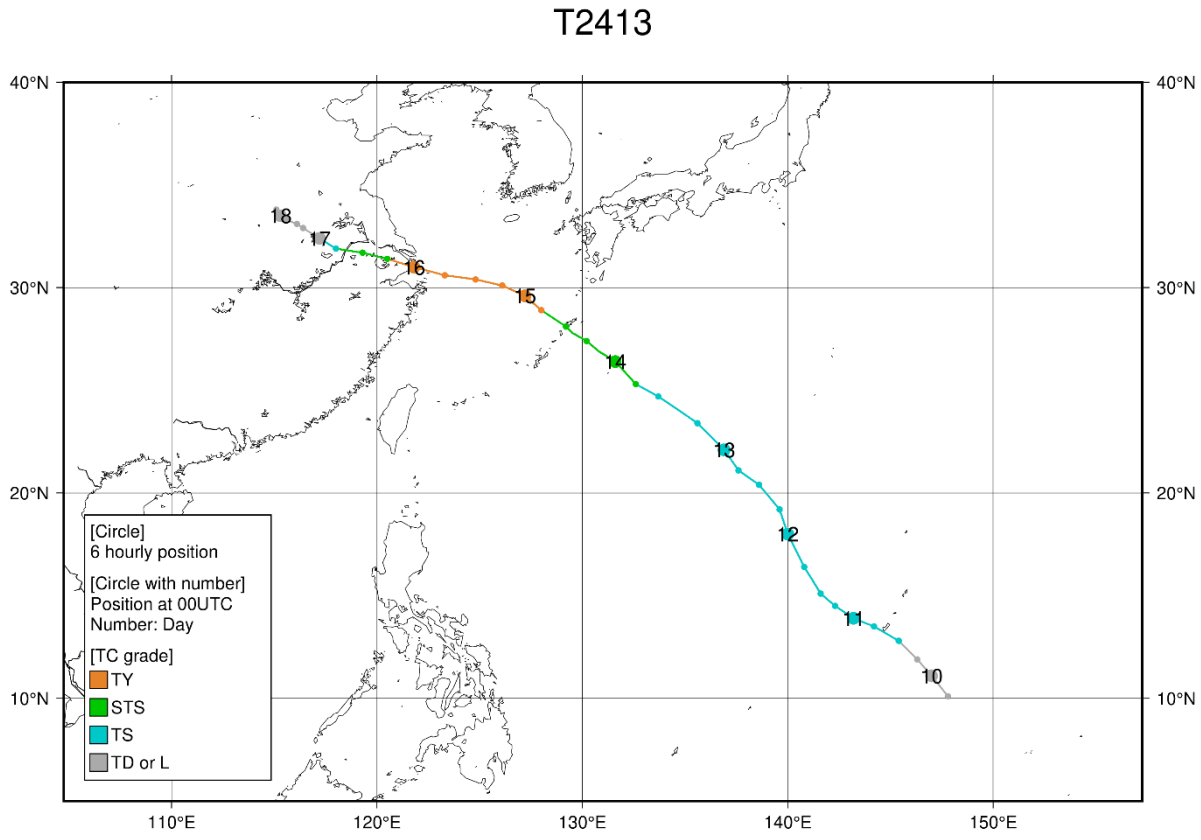
LEEPI (2412)

LEEPI formed as a tropical depression (TD) around the Ogasawara Islands at 12 UTC on 1 September 2024 and moved northwestward. While moving northward, 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 1002 hPa over the sea east of Japan at 00 UTC on 5 September. After turning northeastward, it weakened to TD intensity over the same waters at 12 UTC on 6 September and transitioned into an extratropical cyclone over the sea far off east of Japan by 00 UTC on 7 September. It kept its northeastward track and then crossed longitude 180 degrees east before 18 UTC on 8 September.



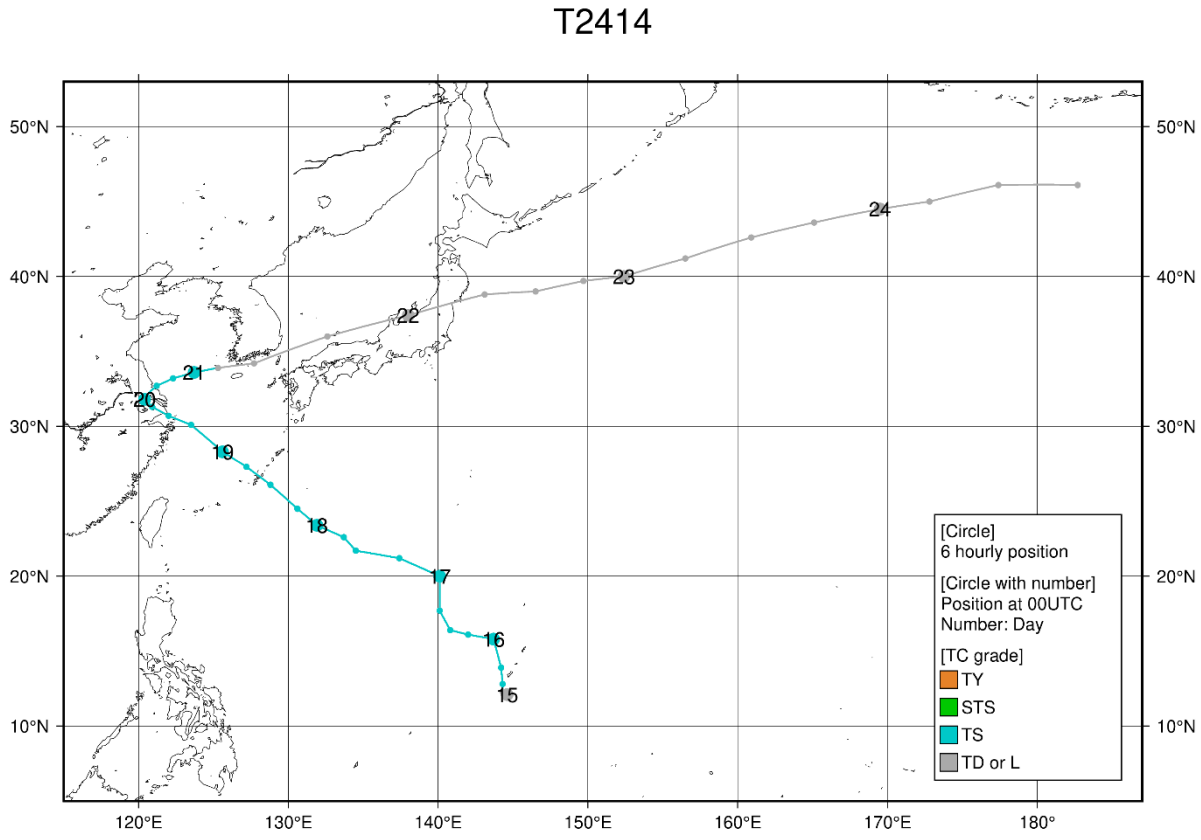
BEBINCA (2413)

BEBINCA formed as a tropical depression (TD) over the sea around the Mariana Islands at 18 UTC on 9 September 2024 and moved northwestward. It was upgraded to tropical storm (TS) intensity over the same waters 18 hours later and moved to the sea south of Japan while keeping its northwestward track. After passing around Amami-Oshima Island, it was upgraded to typhoon (TY) intensity over the East China Sea at 18 UTC on 14 September and reached its peak intensity with maximum sustained winds of 75 kt and a central pressure of 965 hPa over the same waters six hours later. Keeping its northwestward track, it hit Central China with TY intensity around 00 UTC on 16 September and was downgraded to TS intensity 18 hours later. It weakened to TD intensity there at 00 UTC on 17 September and dissipated in North China at 12 UTC on 18 September.



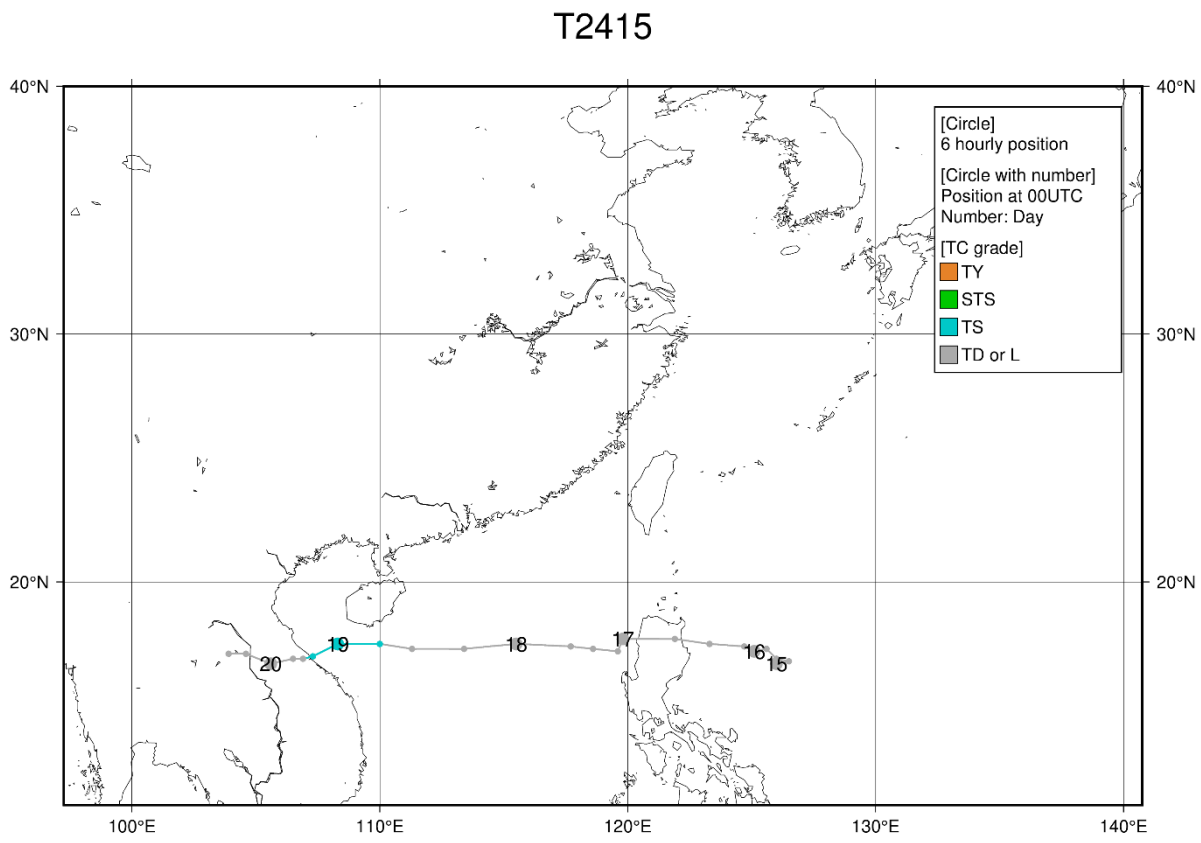
PULASAN (2414)

PULASAN formed as a tropical depression (TD) around the Mariana Islands at 00 UTC on 15 September 2024 and moved northward. It was upgraded to tropical storm (TS) intensity over the same waters 12 hours later and reached its peak intensity with maximum sustained winds of 45 kt and a central pressure of 992 hPa around the Ogasawara Islands at 00 UTC on 17 September. After turning northwestward, it crossed Okinawa Island after 12 UTC on 18 September and hit Central China around 12 UTC on 19 September. After it turned northeastward, it entered the Yellow Sea around 12 UTC on 20 September and transitioned into an extratropical cyclone by 06 UTC the next day. Keeping its northeastward track, it crossed the northern part of Honshu Island around 00 UTC on 22 September. After entering the sea south of the Aleutian Islands, it crossed longitude 180 degrees east before 18UTC on 24 September.



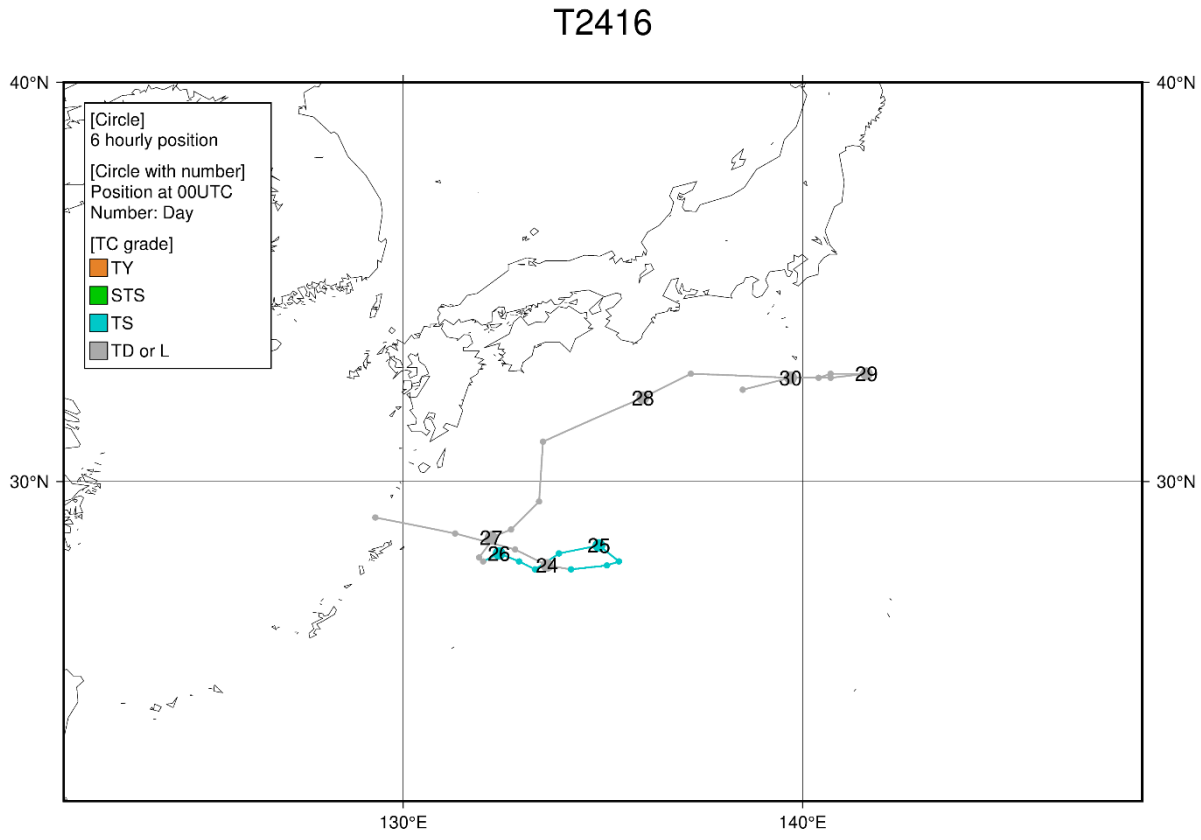
SOULIK (2415)

SOULIK formed as a tropical depression (TD) over the sea east of the Philippines at 00 UTC on 15 September 2024 and moved eastward. It turned westward sharply and crossed north of Luzon Island. After moving southward over the sea west of the island and turning westward again, 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 992 hPa over the South China Sea at 18 UTC on 18 September. Moving westward through the Gulf of Tonkin, it hit Viet Nam with TS intensity and was weakened to TD intensity at 12 UTC on 19 September. It dissipated in Northeast Thailand at 18 UTC the next day.



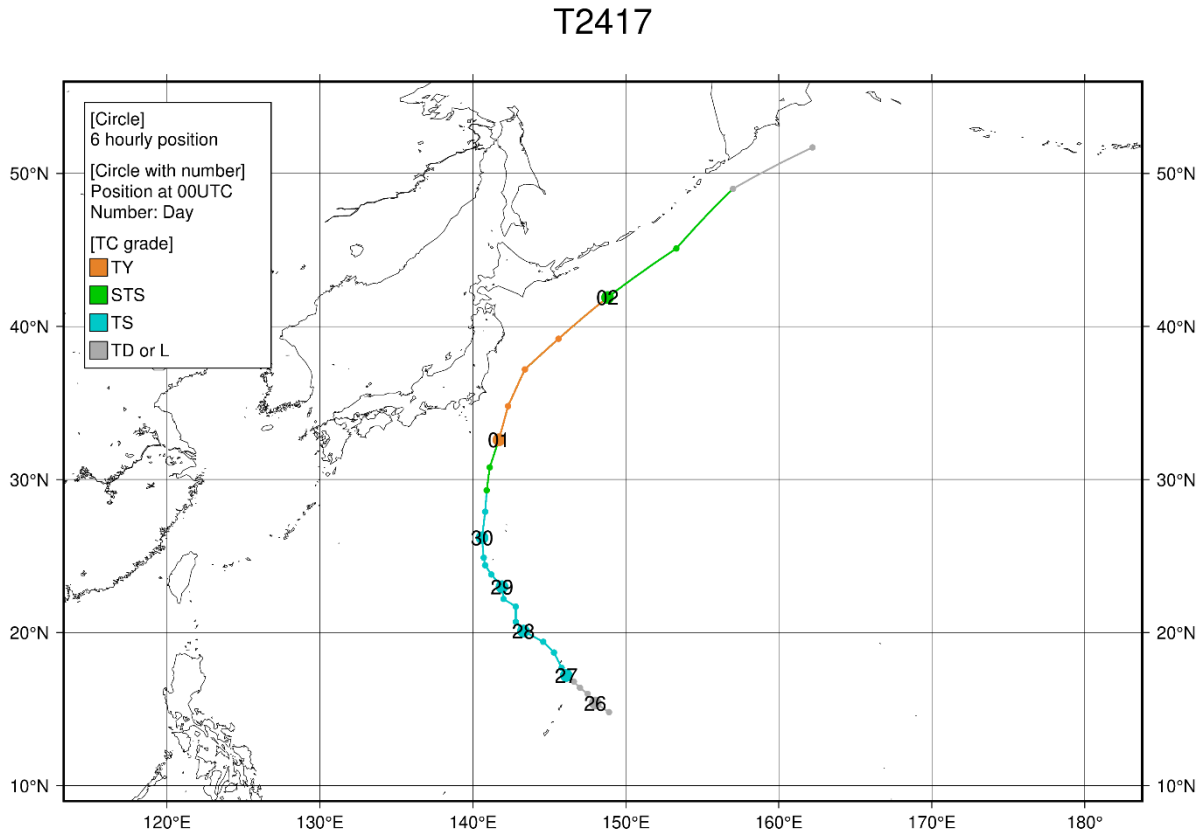
CIMARON (2416)

CIMARON formed as a tropical depression (TD) north of Amami-Oshima Island at 06 UTC on 23 September 2024 and moved southeastward. Moving eastward, it was upgraded to tropical storm (TS) intensity over the sea south of Japan at 06 UTC the next day and reached its peak intensity with maximum sustained winds of 35 kt and a central pressure of 998 hPa six hours later. After it turned in a counterclockwise direction to circle, it moved westward and weakened to TD intensity over the same waters at 06 UTC on 26 September. It turned northeastward and then transitioned into an extratropical cyclone over the same waters by 18 UTC on 27 September. After it gradually turned eastward, it moved to the sea east of Japan by 18 UTC on 28 September. After turning in a counterclockwise direction to circle over the same waters around 00 UTC on 29 September, it moved westward and dissipated over the sea south of Japan at 12 UTC on 30 September.



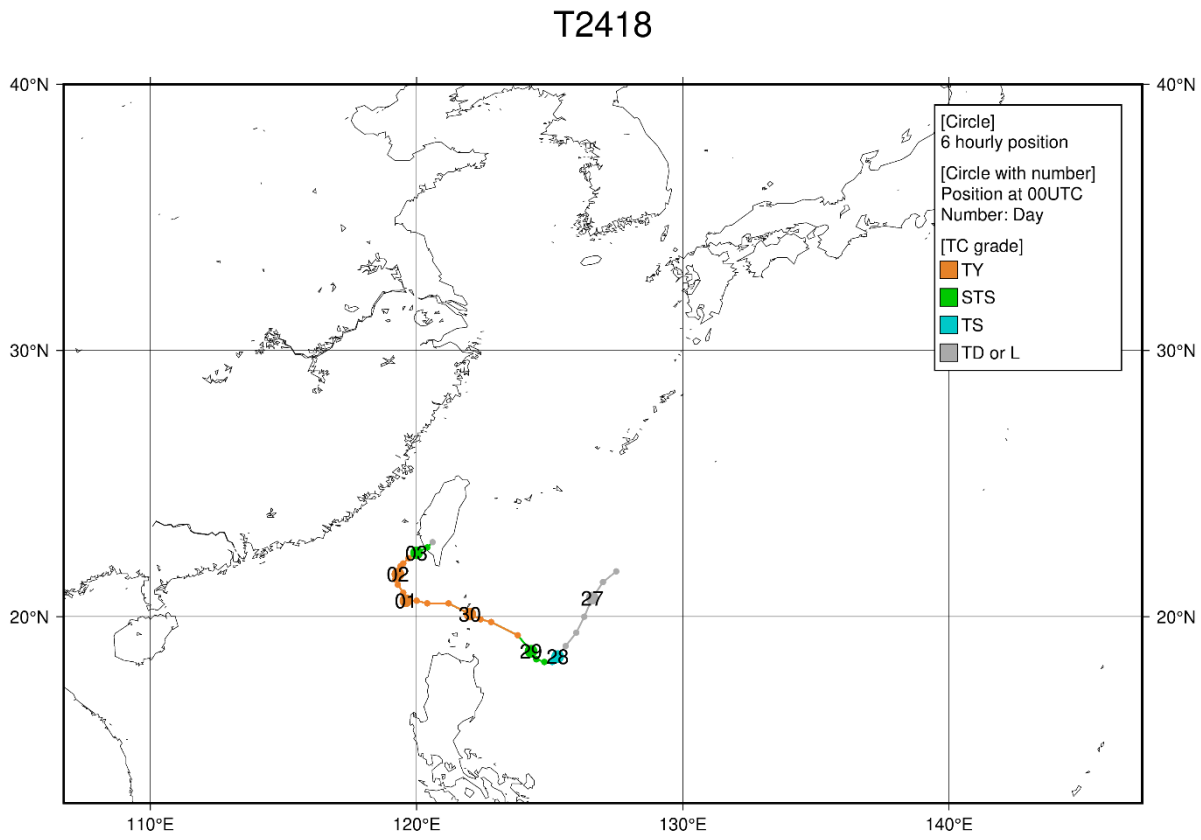
JEBI (2417)

JEBI formed as a tropical depression (TD) over the sea around the Mariana Islands at 18 UTC on 25 September 2024 and moved northwestward. It was upgraded to tropical storm (TS) intensity over the same waters at 00 UTC on 27 September. After gradually turning northward around the Ogasawara Islands, it was upgraded to severe tropical storm (STS) intensity over the same waters at 12 UTC on 30 September. It was further upgraded to typhoon (TY) intensity and reached its peak intensity with maximum sustained winds of 65 kt and a central pressure of 980 hPa over the sea east of Japan at 00 UTC on 1 October. It moved northeastward and was downgraded to STS intensity over the same waters at 00 UTC the next day. It transitioned into an extratropical cyclone over the sea around the Kuril Islands by 12 UTC on 2 October and dissipated over the sea east of the Kamchatka Peninsula 12 hours later.



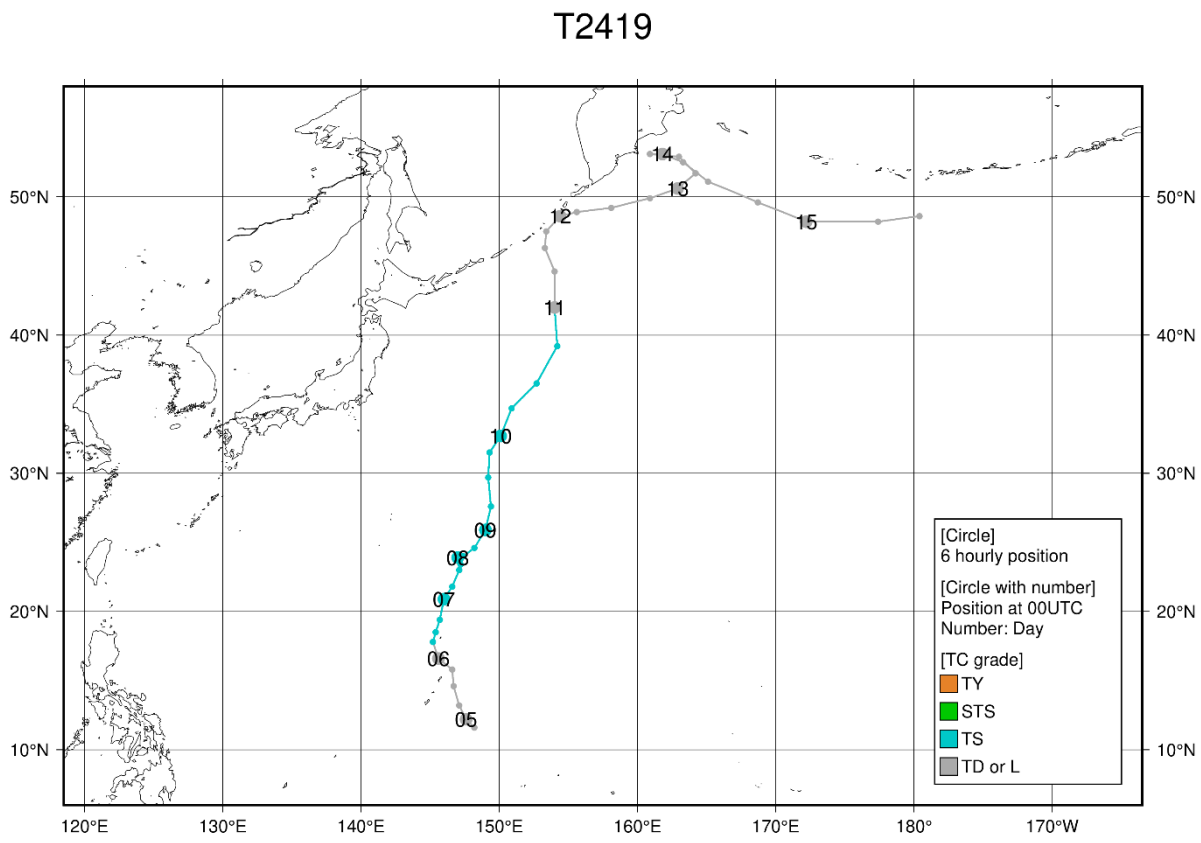
KRATHON (2418)

KRATHON formed as a tropical depression (TD) south of Okinawa at 12 UTC on 26 September 2024 and moved southwestward. Keeping its southwestward track, it was upgraded to tropical storm (TS) intensity east of the Philippines at 00 UTC on 28 September and then moved westward. It was upgraded to severe tropical storm (STS) intensity 12 hours later and then moved northwestward. Keeping its northwestward track, it was upgraded to typhoon (TY) intensity over the same waters at 06 UTC the next day, moved westward and reached its peak intensity with maximum sustained winds of 105 kt and a central pressure of 920 hPa over the South China Sea at 00 UTC on 1 October. After it gradually turned northward, it weakened to STS intensity rapidly over the Bashi Channel at 00 UTC on 3 October. It hit Taiwan with STS intensity before 06 UTC on 3 October. It weakened to TD intensity at 12 UTC on 3 October and then dissipated six hours later.



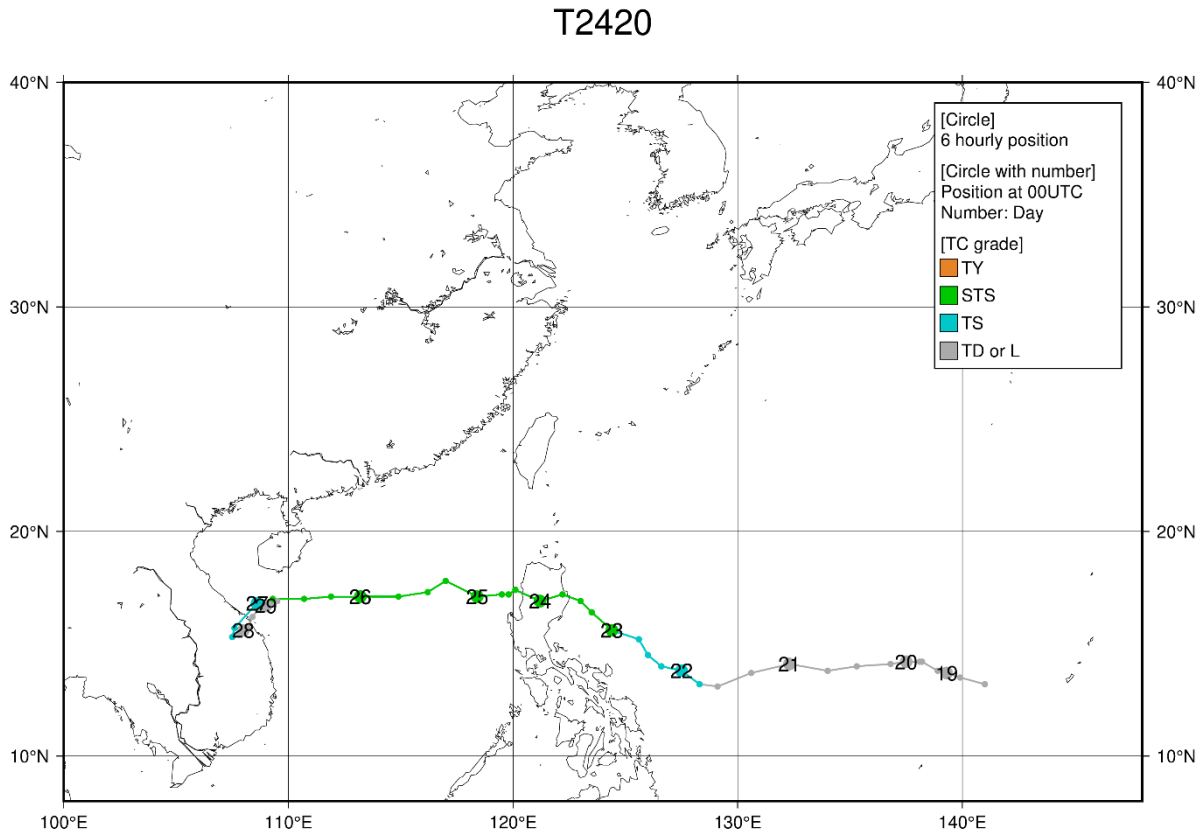
BARIJAT (2419)

BARIJAT formed as a tropical depression (TD) around the Mariana Islands at 18 UTC on 4 October 2024 and moved northward. It was upgraded to tropical storm (TS) intensity over the same waters at 06 UTC on 6 October. Keeping its northward track, it reached its peak intensity with maximum sustained winds of 45 kt and a central pressure of 985 hPa over the far off east of Japan at 18 UTC on 10 October. It transitioned into an extratropical cyclone over the same waters by six hours later. After it moved to the sea around the Kuril Islands and turned eastward, it turned in a counterclockwise direction to circle east of the Kamchatka Peninsula. It moved eastward and crossed longitude 180 degrees east before 12 UTC on 15 October.



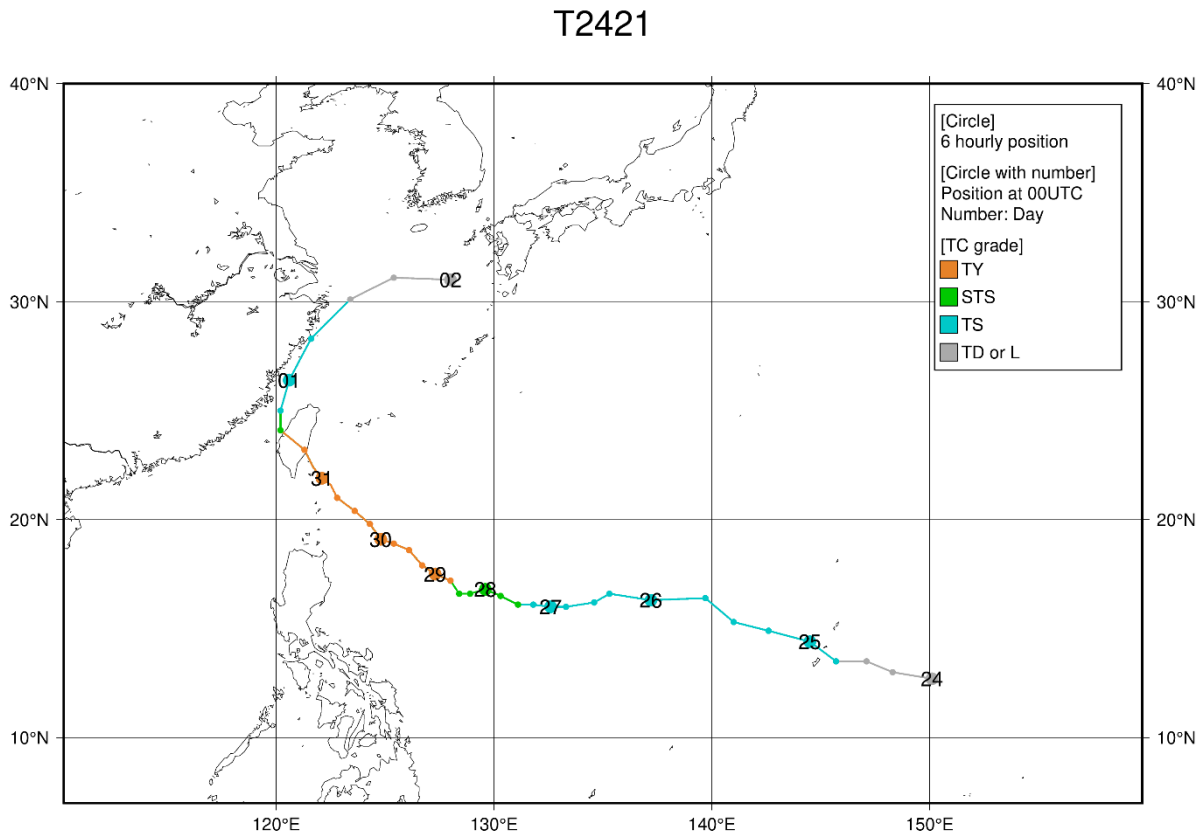
TRAMI (2420)

TRAMI formed as a tropical depression (TD) around the Mariana Islands at 12 UTC on 18 October 2024 and moved westward. It was upgraded to tropical storm (TS) intensity over the sea east of the Philippines at 18 UTC on 21 October and moved northwestward. Keeping its northwestward track, it was upgraded to severe tropical storm (STS) intensity over the same waters at 00 UTC on 23 October. It crossed north of Luzon Island with STS intensity 18 hours later and then moved westward. After entering the South China Sea, it reached its peak intensity with maximum sustained winds of 60 kt and a central pressure of 970 hPa at 06 UTC on 26 October. It was downgraded to TS intensity over the sea east of Viet Nam at 00 UTC on 27 October and then hit Viet Nam. Turning in a counterclockwise direction to circle, it weakened to TD intensity at 18 UTC on 27 October. It entered the South China Sea again and dissipated at 18 UTC on 29 October.



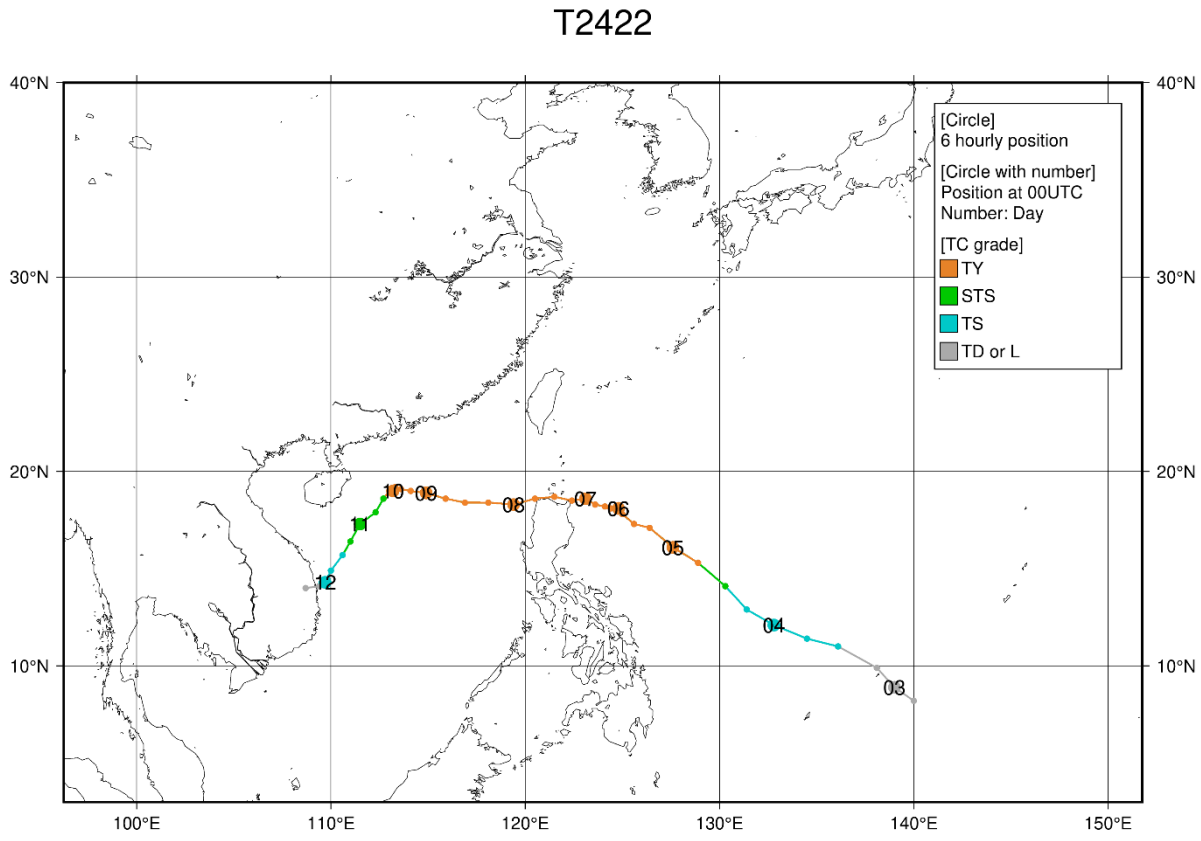
KONG-REY (2421)

KONG-REY formed as a tropical depression (TD) around the Chuuk Islands at 00 UTC on 24 October 2024 and moved westward. It was upgraded to tropical storm (TS) intensity around the Mariana Islands 18 hours later and was further upgraded to typhoon (TY) intensity over the sea east of the Philippines at 18 UTC on 28 October. After turning northwestward, it reached its peak intensity with maximum sustained winds of 100 kt and a central pressure of 925 hPa over the same waters at 00 UTC on 30 October. Keeping its northwestward track, it hit Taiwan with TY intensity around 06 UTC on 31 October and then weakened rapidly. After it entered Taiwan Strait and turned northward, it was downgraded to STS intensity at 12 UTC on 31 October and to TS intensity six hours later. Turning northeastward, it transitioned into an extratropical cyclone over the East China Sea by 12 UTC on 1 November. It moved eastward and dissipated over the same waters 18 hours later.



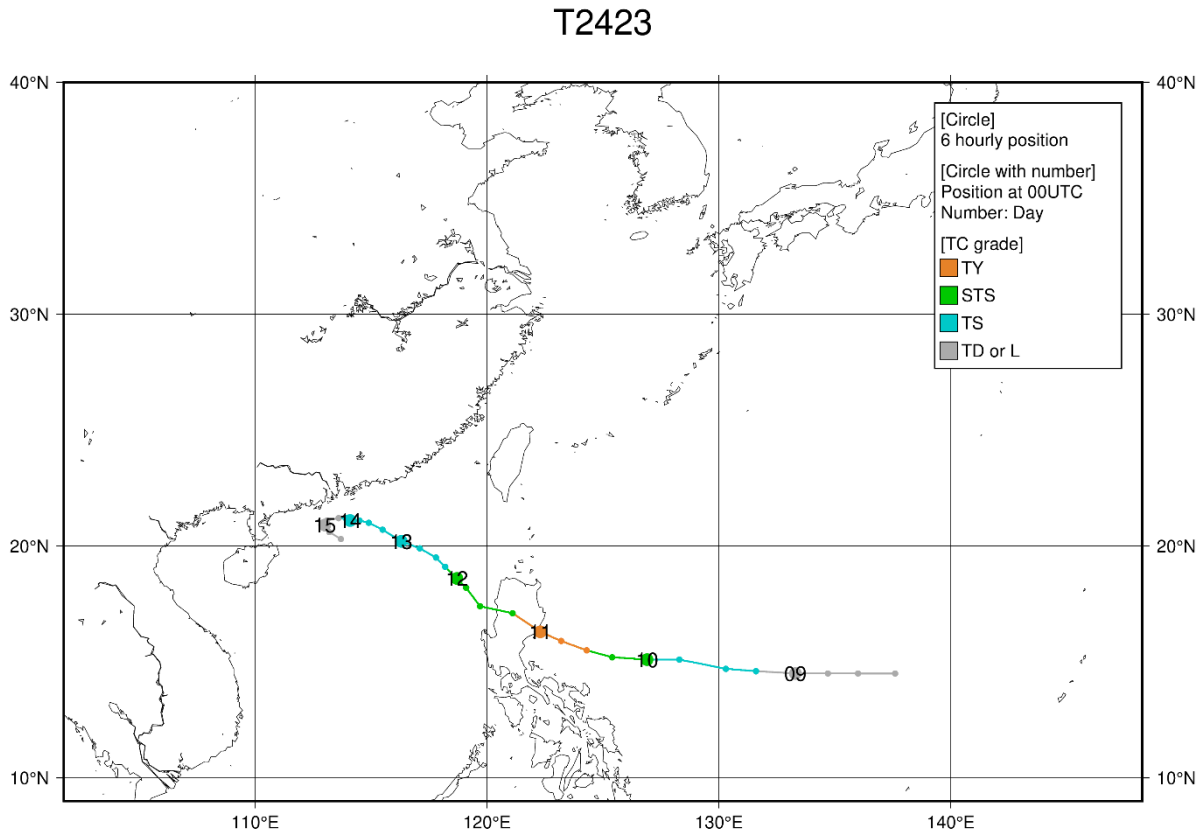
YINXING (2422)

YINXING formed as a tropical depression (TD) around the Caroline Islands at 18 UTC on 2 November 2024 and moved northwestward. It was upgraded to tropical storm (TS) intensity over the sea east of the Philippines 18 hours later. It developed rapidly and was further upgraded to typhoon (TY) intensity at 18 UTC the next day. It reached its peak intensity with maximum sustained winds of 100 kt and a central pressure of 945 hPa over the sea north of the Philippines at 06 UTC on 7 November and moved westward. After entering the South China Sea, it was downgraded to STS intensity at 12 UTC on 10 November and turned southwestward. After weakening to TD intensity over the same waters at 06 UTC on 12 November, it hit Viet Nam and dissipated 12 hours later.



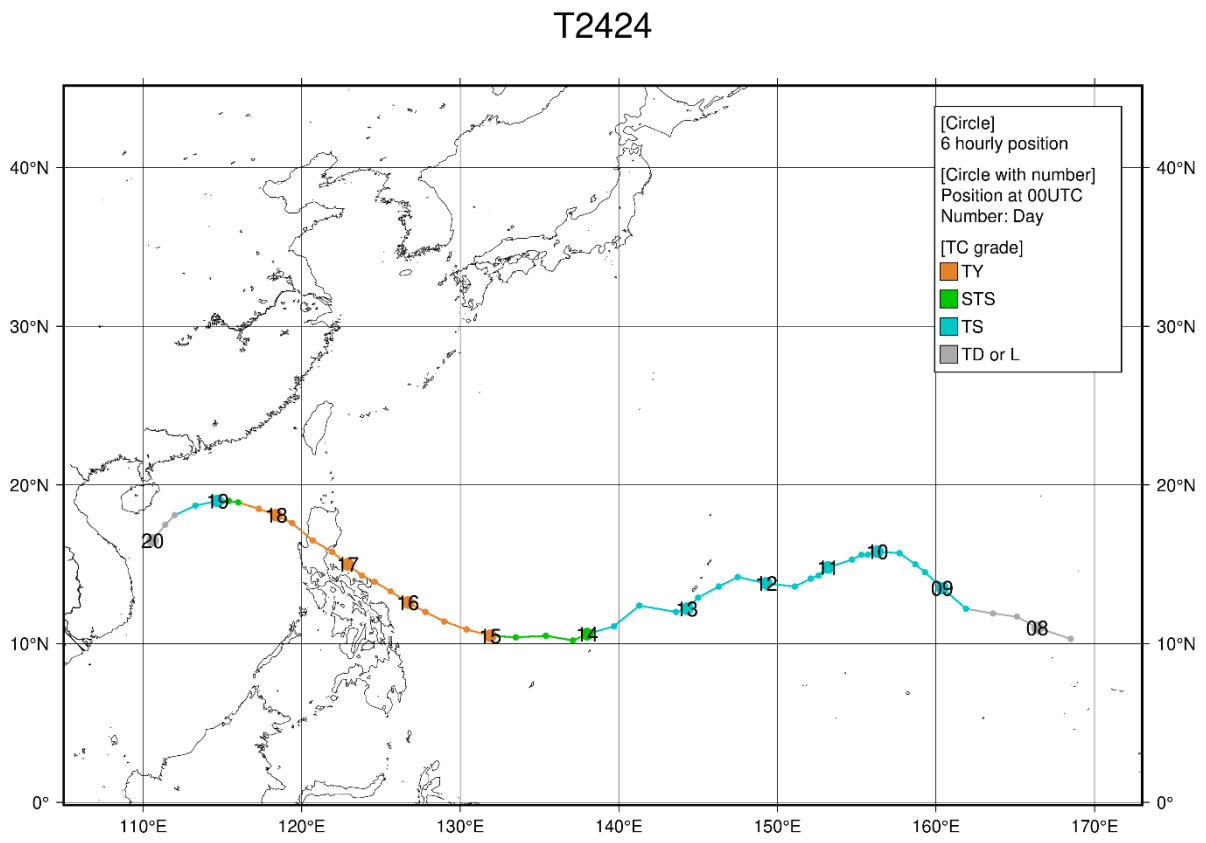
TORAJI (2423)

TORAJI formed as a tropical depression (TD) over the sea east of the Philippines at 06 UTC on 8 November 2024 and moved westward. After upgraded to tropical storm (TS) intensity over the same waters at 06 UTC on 9 November, it developed rapidly and was further upgraded to typhoon (TY) intensity at 12 UTC the next day. It reached its peak intensity with maximum sustained winds of 70 kt and a central pressure of 980 hPa over the same waters at 18 UTC on 10 November. Keeping its westward track, it crossed north of Luzon Island with TY intensity after 00 UTC on 11 November and entered the South China Sea. Turning northwestward, it was downgraded to TS intensity over the same waters at 06 UTC on 12 November and weakened to TD intensity at 12 UTC on 14 November. After turning southeastward, it dissipated over the same waters at 18 UTC on 15 November.



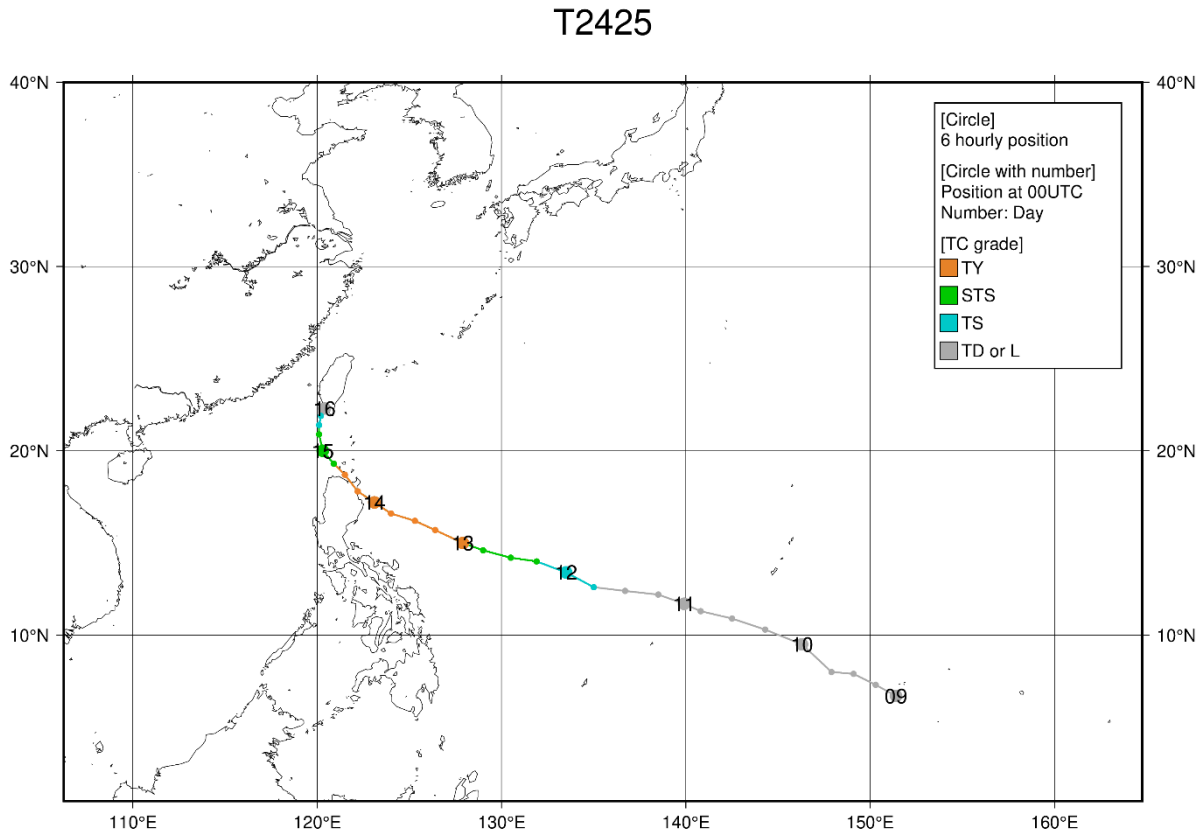
MAN-YI (2424)

MAN-YI formed as a tropical depression (TD) around the Marshall Islands at 18 UTC on 7 November 2024 and moved westward. It was upgraded to tropical storm (TS) intensity at 18 UTC the next day and moved northwestward. Gradually turning southwestward around the Mariana Islands, it was upgraded to severe tropical storm (STS) intensity over the sea east of the Philippines at 00 UTC on 14 November and turned westward. Developing rapidly, it was further upgraded to typhoon (TY) intensity at 00 UTC on 15 November and turned northwestward. It reached its peak intensity with maximum sustained winds of 105 kt and a central pressure of 920 hPa over the same waters at 00 UTC the next day. Keeping its TY intensity and northwestward track, it crossed north of Luzon Island at 06 UTC on 17 November and then weakened rapidly. After entering the South China Sea, it was downgraded to STS intensity at 12 UTC on 18 November and turned southwestward. It further weakened to TD intensity at 12 UTC the next day. Keeping its southwestward track, it dissipated over the same waters 18 hours later.



USAGI (2425)

USAGI formed as a tropical depression (TD) around the Chuuk Islands at 00 UTC on 9 November 2024 and moved northwestward. It was upgraded to tropical storm (TS) intensity over the sea east of the Philippines at 18 UTC on 11 November. Developing rapidly over the same waters, it was further upgraded to typhoon (TY) intensity at 00 UTC on 13 November and reached its peak intensity with maximum sustained winds of 95 kt and a central pressure of 940 hPa at 00 UTC the next day. Keeping its northwestward track, it crossed north of Luzon Island with TY intensity around 06 UTC on 14 November and weakened rapidly. After gradually turning northward, it was downgraded to TS intensity over the Bashi Channel at 12 UTC on 15 November and weakened to TD intensity over the sea south of Taiwan 12 hours later. It remained almost stationary around south of Taiwan and dissipated at 18 UTC on 16 November.



PABUK (2426)

PABUK formed as a tropical depression (TD) over the South China Sea at 18 UTC on 21 December 2024 and moved westward. 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 1002 hPa over the same waters at 06 UTC on 22 December. It moved northwestward and gradually turned southwestward around 00 UTC on 24 December. It weakened to TD intensity at 18 UTC on 24 December. Keeping its southwestward track, it dissipated over the same waters at 18 UTC on 25 December.