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**TYPHOON COMMITTEE**

**OPERATIONAL MANUAL**

**METEOROLOGICAL COMPONENT**

**2018 Edition**



SECRETARIAT OF THE WORLD METEOROLOGICAL ORGANIZATION

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## CHAPTER 1

**GENERAL**

##### 1.1 Introduction

Typhoons have always been a major threat to the Typhoon Committee region. As a result, they are a common target for meteorological services in the region to monitor, analyse, forecast and warn against.

Under the spirit of international co-operation, a regional programme to mitigate the damage due to tropical cyclones was launched by the Typhoon Committee which was established in 1968. Since its establishment under the auspices of ESCAP in co-operation with the World Meteorological Organization (WMO), the Typhoon Committee has developed its area of activities to consist of three components, i.e., meteorological, hydrological and disaster prevention and preparedness.

Of these components, the meteorological component aims at improving and upgrading the analysis and forecast used for the routine operation. For this purpose, the Typhoon Committee has arranged a variety of co-operation efforts. One of the epoch-making events in the history of the Committee was the Typhoon Operational Experiment (TOPEX), which was organized for all three components. The third component was specifically organized as Warning Dissemination and Information Exchange Component.

The Meteorological Component of TOPEX had a co-operation programme where concerted efforts were exerted to analyze and forecast specified typhoons using common technical procedures. The procedures were described in the TOPEX Operational Manual which had been utilized in meteorological services in the Typhoon Committee region during the operational phase of TOPEX.

Activities of the Meteorological Component of the Typhoon Committee – including execution of the meteorological component of TOPEX for three years – had been planned and organized under the Tropical Cyclone Programme (TCP) of the WMO. The main long-term objective of the TCP is to assist Members in upgrading the capabilities of National Meteorological and Hydrological Services (NMHSs) to provide better tropical cyclone, related flood and storm surge forecasts and more effective warnings through regionally coordinated systems, and to encourage Members to establish national disaster prevention and preparedness measures.

As a result of international cooperation and coordination, and with the aid of meteorology and modern technology, such as satellites, weather radars and computers, all tropical cyclones around the globe are now being monitored from their early stages of formation and throughout their lifetime. Six centres designated by WMO as Regional Specialized Meteorological Centres (RSMCs) located in Honolulu, La Reunion, Miami, Nadi (Fiji), New Delhi and Tokyo, as well as other centres of National Meteorological Services (NMSs) carry out these activities. These centres also provide forecasts on the behaviour of tropical cyclones, their movement and changes in intensity and on associated phenomena – principally storm surges and flash floods.

The responsibility of the RSMC Tokyo - Typhoon Center is the provision of information on tropical cyclones for Members of the Typhoon Committee. Information should include formation, movement and development of tropical cyclones and associated meteorological phenomena. In addition, synoptic scale atmospheric situation which affects the behaviour of tropical cyclones should also be prepared by the RSMC Tokyo - Typhoon Center and disseminated to National Meteorological Centers (NMCs) in the appropriate format for operational processing. The RSMC Tokyo - Typhoon Center should be operational throughout the year and be manned round the clock when a tropical cyclone exists over the region concerned. The RSMC Tokyo - Typhoon Center should also carry out non-operational functions such as training.

In order to implement the RSMC Tokyo - Typhoon Center in the Typhoon Committee region, the Regional Co-operation Programme was discussed and adopted by the Typhoon Committee at its Extraordinary Session (Manila, March 1986). At the same time, the Committee approved a draft of the Typhoon Committee Operational Manual which specifies in more detail the extent and type of activity of the RSMC Tokyo - Typhoon Center and shows the direction of realizing the regional co-operation between Members.

The Operational Manual consists of the text and the appendices. Items included in the text relate to the Typhoon Committee agreement, in particular, basic information for executing meteorological operation, whilst the appendices contain national practices and procedures (it is felt that the Member concerned should have the right to be able to change without having to get prior formal agreement of the Typhoon Committee) together with detailed and technical information for meteorological operation. Information described in WMO official publications such as Manuals is only referred to and not included in this Manual.

Since March 1986, the draft of the Operational Manual has been revised and is still subject to further refinement and revision through experience gained in the use of the Operational Manual. It is also intended that the text of the Manual be updated or revised from time to time by the Typhoon Committee and that each item of information given in the appendices relating to the Manual be kept up to date by the Members concerned.

##### 1.2 Terminology used in the region

1.2.1 General

Typhoon Committee Members

1.2.2 Classification of tropical cyclones[[1]](#footnote-1)\*

(i) Low pressure area (L)

(ii) Depression or tropical depression (TD)

(iii) Tropical storm (TS)

(iv) Severe tropical storm (STS)

(v) Typhoon (TY)

1.2.3 Tropical cyclone characteristics

(i) position of centre

(ii) confidence in the centre position

(iii) size and shape of eye, if any

(iv) central pressure

(v) direction of movement

(vi) speed of movement

(vii) maximum sustained wind

(viii) gusts

(ix) storm radius

(x) gale radius

(xi) storm surge potential for a particular coastal location

(xii) storm tide potential for a particular coastal location

1.2.4 Terms related to the warning and warning system

(i) typhoon season

(ii) tropical cyclone advisory

(iii) tropical cyclone information bulletin

(iv) gale warning

(v) storm warning

(vi) typhoon warning

(vii) visual storm signals

(viii) high sea bulletin

(ix) coastal weather bulletin

(x) bulletin or cyclone warning bulletin

##### 1.3 Meaning of terms used for regional exchange

Average wind speed: Speed of the wind averaged over the previous 10 minutes (mean surface wind) as read from the anemogram or the 3 minutes mean determined with the non-recording anemometer or wind averaged over the previous 1 minute (mean surface wind) at 10 meter height or estimated wind at sea by mariners using the Beaufort scale.

Bulletin: Cyclone warning bulletin

Central pressure of a tropical cyclone: Surface pressure at the centre of the tropical cyclone as measured or estimated.

Centre fix of the tropical cyclone: The estimated location of the centre of a tropical cyclone.

Centre of the tropical cyclone: The centre of the cloud eye, or if not discernible, of the wind/pressure centre.

Confidence in the centre position: Degree of confidence in the centre position of a tropical cyclone expressed as the radius of the smallest circle within which the centre may be located by the analysis. "Position good" implies a radius of 30 nautical miles (55 kilometres) or less. "Position fair", a radius of 30 to 60 nautical miles (55 to 110 km) and "Position poor", a radius of greater than 60 nautical miles (110 km).

Cyclone: Tropical cyclone

Cyclone warning bulletin: A priority message for exchange of tropical cyclone information and advisories.

Direction of movement of the tropical cyclone: The direction towards which the centre of the tropical cyclone is moving.

Extra-tropical cyclone: A former tropical cyclone that has gone through extra-tropical transition and lost its initial tropical characteristics.

Extra-tropical transition: is an evolutionary process by which a symmetric warm core tropical cyclone transforms to an asymmetric cold core extratropical cyclone. This process includes a change in the distribution of clouds, winds, and precipitation. Also, the primary energy source changes from latent heat release in deep convective clouds of the tropical cyclone to baroclinic conversion of available potential energy in the extratropical cyclone.

Eye of the tropical cyclone: The relatively clear and calm area inside the circular wall of convective clouds, the geometric centre of which is the centre of the tropical cyclone.

Gale force: Average wind speed in the range of 34 knots (17.2 m/s, 62 km/h) to 47 knots (24.4 m/s, 88 km/h), or wind force 8 or 9 in the Beaufort scale.

Gale warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of gale force wind.

Gust: Instantaneous peak value of surface wind speed.

Low pressure area: Region of the atmosphere in which the pressures are lower than those of the surrounding region at the same level. (On the weather map, the low pressure area is denoted with the capital L within the innermost isobar without showing the centre position.)

Maximum sustained wind[[2]](#footnote-2): Maximum value of the average wind speed at the surface.

Mean wind speed: Average wind speed.

Reconnaissance aircraft centre fix of the tropical cyclone, vortex fix: The location of the centre of a tropical cyclone obtained by reconnaissance aircraft penetration.

Severe tropical storm: A tropical cyclone with the maximum sustained winds at storm force near the centre.

Speed of movement of the tropical cyclone: Speed of movement of the centre of the tropical cyclone.

Storm force: Average wind speed of 48 knots (24.5 m/s, 89 km/h) to 63 knots (32.6 m/s, 117 km/h) , or wind force 10 or 11 in the Beaufort scale.

Storm surge: The difference between the actual water level under the influence of a meteorological disturbance (storm tide) and the level which would have been attained in the absence of the meteorological disturbance (i.e. astronomical tide). (Storm surge results mainly from the shoreward movement of water under the action of wind stress. A minor contribution is also made by the hydrostatic rise of water resulting from the lowered barometric pressure.)

Storm tide: The actual sea level as influenced by a weather disturbance. The storm tide consists of the normal astronomical tide and the storm surge.

Storm warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of storm force wind.

Sub-tropical cyclone: A low pressure system, developing over sub-tropical waters which initially contains few tropical characteristics. With time the sub-tropical cyclone can become tropical.

Sustained wind speed: Average wind speed. Average period of one, three or ten minutes is depending upon the regional practices.

Tropical cyclone: Generic term for a non-frontal synoptic scale cyclone originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation. (The term is also used for a storm in the South-West Indian Ocean in which the maximum of the sustained wind speed\* is estimated to be in the range of 64 to 90 knots and in the South Pacific and South-East Indian Ocean with the maximum of the sustained over 33 knots.)

Tropical cyclone advisory: A priority message for exchanging information, internationally, on tropical cyclones.

Tropical cyclone coastal crossing: Cyclone centre passage across the coast.

Tropical depression: A tropical cyclone with the maximum sustained winds of 33 knots (17.1 m/s, 61 km/h) or less near the centre.

Tropical disturbance: A non-frontal synoptic scale cyclone originating in the tropics or sub-tropics with enhanced convection and light surface winds.

Tropical cyclone impact: Evidence of damage or disruption caused by tropical cyclone-generated hazard(s) either direct or indirect. (includes damaging large swells from distant tropical cyclones).

Tropical cyclone island crossing: Cyclone centre passage across the island.

Tropical cyclone landfall: refer to tropical cyclone coastal crossing.

Tropical storm: A tropical cyclone with the maximum sustained winds at gale force near the centre.

Tropical wave: A trough or cyclonic curvature maximum in the trade wind easterlies or equatorial westerlies. The wave may reach maximum amplitude in the lower middle troposphere, or may be the reflection of an upper-troposphere cold low or equatorial extension of a mid-latitude trough.

Typhoon: A tropical cyclone with the maximum sustained winds at typhoon force near the centre.

Typhoon force: Average wind speed of 64 knots (32.7 m/s, 118 km/h) or more, or wind force 12 in the Beaufort scale.

Typhoon warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of typhoon force wind.

Visual storm signals: Visual signals displayed at coastal points to warn ships of squally winds, gales and tropical cyclones.

Weather warning: Meteorological message issued to provide appropriate warnings or hazardous weather conditions.

Zone of disturbed weather: A zone in which the pressure is low relative to the surrounding region and there are convective cloud masses which are not organized.

##### 1.4 Units used for regional exchange

(a) The following units/indicators are used for marine purposes:

1. Distance in nautical miles, the unit (nm) being stated;
2. Location (position) by degrees and where possible tenths of degrees of latitude and longitude preferably expressed by words;
3. Direction to the nearest sixteen points of the compass or in degree to the nearest ten, given in words;
4. Speed (wind speed and speed of movement of tropical cyclones) in knots, the unit (kt) being stated;
5. Confidence in the centre position in nautical miles (nm) or in position good, fair or poor;

(b) The following units/indicators are used in non-coded segments of exchanges, other than marine bulletins:

1. Distance in kilometres (km) or nautical miles (nm);
2. Location (position) by degrees and tenths of degrees in figures of latitude and longitude and/or bearing on the sixteen point compass and distance from well-known fixed place(s);
3. Direction in sixteen points of compass given in figures;
4. Speed (wind speed and speed of movement of system) in knots (kt), metres per second (m/s) or kilometres per hour (km/h);
5. Confidence in the centre position in kilometres (km), nautical miles (nm) or in position good, fair or poor.

##### 1.5 Identification of tropical cyclones

As soon as the wind speed in a tropical cyclone in the responsible area of the RSMC Tokyo - Typhoon Center (between 0°N and 60°N and between 100°E and 180°E) attains 34 knots, it will be given an identification name with a 4-digit number by the RSMC Tokyo - Typhoon Center. Each tropical cyclone should be identified by one of the names in Appendix [1-B](#_APPENDIX_1-C,_p.1), followed by the 4-digit number in brackets, whose number will consist of a year identification and a serial number identification (in two digits each). For example, the first tropical cyclone attaining the 34 knots threshold value in 2000 in the responsible area of the RSMC Tokyo-Typhoon Center will be identified as Damrey (0001). If the life of a tropical cyclone spans two calendar years, it will be accounted for in the year in which it has intensified to the stage where the wind speed has attained the 34 knots threshold value.

##### 1.6 Acronyms

A list of acronyms used in this Operational Manual is shown in Appendix [1-C](#_APPENDIX_1-D).

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## CHAPTER 2

**OBSERVING SYSTEM AND OBSERVING PROGRAMME**

##### 2.1 Networks of synoptic land stations

The surface and upper-air stations in the regional basic synoptic network are those of the Typhoon Committee Members and are registered in Weather Reporting Volume A - Observing stations (WMO Publication No. 9).

The RSMC Tokyo - Typhoon Center and all Typhoon Committee Members should initiate enhanced observation programmes for their stations in the area within 300 km of the centre of a tropical cyclone of TS intensity or higher. All the observations should be made available to the RSMC Tokyo - Typhoon Center and all Members. Enhanced observations should include:

1. surface observations - hourly;
2. buoy observations - hourly;
3. radar observations - hourly;
4. upper-air observations - 6-hourly.

2.1.1 Surface observations

All surface stations included in the regional basic synoptic network should make surface observations at the four main standard times of observation, i.e., 0000, 0600, 1200 and 1800 UTC, and at the four intermediate standard times of observation, i.e., 0300, 0900, 1500 and 2100 UTC. Any surface station that cannot carry out the full observational programme should give priority to carrying out the observations at the main standard times. Additional surface observations at hourly intervals may be requested by any Member, whenever a tropical cyclone becomes an imminent threat to the Member, from the stations shown in Appendix [2-A](#_APPENDIX_2-A,_p.1).

2.1.2 Upper-air synoptic observations

All the upper-air stations included in the regional basic synoptic network should carry out radiosonde and radiowind observations at 0000 and 1200 UTC, and radiowind observations at 0600 and 1800 UTC. The radiosonde/radiowind observations carried out at 0000 and 1200 UTC should reach the 30 hPa level for more than 50 per cent of the ascents. The carrying out of the radiosonde/radiowind observations at 0000 and 1200 UTC should receive priority over the radiowind observations at 0600 and 1800 UTC.

Upper-air stations in the areas affected by tropical cyclones of TS intensity or higher should also make radiowind observations at 0600 and 1800 UTC which should aim at reaching the 70 hPa level.

Enhanced upper-air observations given in Appendix [2-B](#_APPENDIX_2-B,_p.1) will be made as appropriate whenever a tropical cyclone of TS intensity or higher is centred within 300 km of the station. The minimum required is two observations per day, but for a better understanding of the ambient wind field three or even four ascents per day on some days should be made when possible. All data of these enhanced upper-air observations will be distributed among the Members.

In addition to the upper-air synoptic observations, newly developed observations such as wind profiler observations should be carried out when possible and the data should be made available to the Members.

##### 2.2 Ship and buoy observations

Hourly marine meteorological observations are made by the JMA research vessels (call signs of them are: JPBN and JGQH) in the seas adjacent to Japan and in the western North Pacific.

Upper-air observations are usually made twice a day (00, 12 UTC) on board the JMA research vessel JGQH. Enhanced upper-air observations are carried out six‑hourly when the vessel is in the vicinity of a tropical cyclone of TS intensity or higher.

Marine meteorological observations are made by the Voluntary Observing Ships which are recruited by the Members in accordance with the WMO Voluntary Observing Ship's Scheme. These are generally carried out every six hours and transmitted over the GTS. In addition, marine meteorological observations are reported hourly by on-board automatic weather stations on some of the Voluntary Observing Ships.

Marine meteorological observations, such as air pressure, sea surface temperature, significant wave height and period, are also made by the drifting ocean data buoys by the Members. All reports are coded in the BUOY code (FM18), and immediately put onto the GTS. A list of the drifting buoy observations by the Members is shown in Appendix [2-C](#_APPENDIX_2-C).

##### 2.3 Radar observations

It is essential that radar observations continue as long as a tropical cyclone of TS intensity or higher remains within the detection range of the radar. All meteorological centres should co-operate to ensure that the radar observations are transmitted through the GTS to the RSMC Tokyo - Typhoon Center and all Members. Reports will be coded in the BUFR code (FM-94) with RADOB Template (TM316050) and/or the RADOB code (FM 20-VIII).

In case the report is in plain language, the full range of information available at the radar station should be given. The message will therefore include, where available, the confirmation of the determination of the centre, the shape, definition, size and character tendency of the eye, the distance between the end of the outermost band and the centre of the cyclone and the direction and speed of movement with a statement of the interval of time over which the movement was calculated.

Distribution of the radar stations and detailed information on the radar equipment of the Typhoon Committee Members are given in Appendices [2-D](#_APPENDIX_2-DC) and [2-E](#_APPENDIX_2-ED,_p.1).

##### 2.4 Meteorological satellite observations

2.4.1 Satellite imagery data and related products

JMA started the operation of its new geostationary meteorological satellite, Himawari-8, at 02:00 UTC on 7 July 2015, replacing the previous satellite MTSAT-2. The agency also launched Himawari-9, which is identical to the Himawari-8 unit, on 2 November 2016. After a period of in-orbit testing, Himawari-9 began serving as back-up to Himawari-8 on 10 March 2017 and will continue in this role until the planned switchover in or around 2022. This dual combination of new-generation satellites will support JMA’s stable provision of continuous satellite observation data for the Asia-Oceania region until 2029.

The meteorological satellite information obtained by Himawari-8/9 and related products are operated as follows:

1. full disk data are obtained every 10 minutes with 16 observation bands;
2. target area data are obtained every 2.5 minutes;
3. AMV data are derived hourly;
4. Clear Sky Radiance (CSR) data are derived hourly from the full disk data.

Detailed information is given in Appendix [2-F](#_APPENDIX_2-FE).

A list of satellite imagery receiving facilities at meteorological centres of the Typhoon Committee Members is given in Appendix [2-G](#_APPENDIX_2-GF,_p.1).

2.4.2 SAREP reports

SAREP reports (Part A) are disseminated eight times a day in the following cases from the RSMC Tokyo - Typhoon Center to Typhoon Committee Members through the GTS under the heading of IUCC10 RJTD in the BUFR code (FM 94):

1. when a tropical cyclone of TS intensity or higher is located in the responsible area of the RSMC Tokyo - Typhoon Center;
2. when a tropical depression existing in the responsible area is forecasted to have an intensity of TS or higher within 24 hours; or
3. when an area of wind speed of 34 knots or higher caused by a tropical cyclone is forecasted to be in the responsible area within 24 hours.

SAREP reports are also issued by other Typhoon Committee Members. A list of SAREP reports issued by the RSMC Tokyo – Typhoon Center and other Typhoon Committee Members is shown in Appendix [2-H](#_APPENDIX_2-H).

##### 2.5 Aircraft observations

Reports from aircraft in flight (AIREPs) in the Typhoon Committee Members areas are collected and exchanged according to the Regional OPMET Bulletin Exchange (ROBEX) scheme[[3]](#footnote-3)\*.

AIREPs in the north-east Pacific area are also collected by the centres at Honolulu, Washington, etc., and relayed to Tokyo.

AMDAR (Aircraft Meteorological Data Relay) reports are collected by the NMHSs involved in respective AMDAR Programmes and relayed via the GTS to the centre at Tokyo.

All reports will be disseminated in real-time to the RSMC Tokyo - Typhoon Center and to other Members through GTS and AFTN circuits.

The Members conduct reconnaissance flights for selected tropical cyclones. Detailed information of reconnaissance flights conducted by the Members is given in Appendix [2-I](#_APPENDIX_2-I).

##### 2.6 Tropical cyclone passage report

Each Member’s tropical cyclone forecast center should compile reliable passage, landfall, near-buoy passage and near-ship passage data, tabulate that data and send it to the Typhoon Committee Secretariat (TCS) within a week after cyclone passage for distribution to other Members. The task is assigned to the focal point for the meteorological component of each Member. A proposed tropical cyclone passage report form is shown in Appendix [2-J](#_APPENDIX_2-JG).

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## CHAPTER 3

**TROPICAL CYCLONE ANALYSIS AND FORECAST**

##### 3.1 Analysis at RSMC Tokyo - Typhoon Center

The RSMC Tokyo - Typhoon Center should produce analyses of various meteorological parameters in chart form and/or in grid point value depending on the facilities of NMCs to process these products. These analyses should include pressure distribution at the sea level and temperature, geo-potential height, humidity and wind at selected pressure levels.

The streamline analysis is indispensable over the tropical region for forecasting tropical cyclones. The RSMC Tokyo - Typhoon Center should produce streamline analyses of the upper and lower atmospheric levels utilizing cloud motion wind, aircraft reports, as well as upper-air observations. Furthermore, the RSMC Tokyo - Typhoon Center should issue analyses of ocean wave and sea surface temperature for the western North Pacific. A list of products provided by the RSMC Tokyo - Typhoon Center is given in Tables 3.1 to 3.4.

The RSMC Tokyo - Typhoon Center should produce additional analyses of the tropical cyclone when it is in the responsible area, based on the enhanced observations. Such analyses should be disseminated in the form of additional bulletins consisting of information on:

1. position of the tropical cyclone;
2. direction and speed of movement;
3. central pressure;
4. maximum wind and wind distribution.

Various analyses based on Himawari data other than cloud imagery itself should be produced by the RSMC Tokyo - Typhoon Center. Analysis of sea-surface temperature combining satellite data and in-situ measurements should be prepared every five days. These analyses are useful for the better understanding of the tropical atmosphere and medium-range assessment of forecasting tropical cyclones.

**Table 3.1 Chart-form products provided by**

**RSMC Tokyo - Typhoon Center for regional purposes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Area | Contents and Level | Forecast hours | Initial time | Availability |
| A’ (Far East) | 500hPa (Z, ζ) | Analysis | 00, 12UTC | GTS |
| 24, 36 | 00, 12UTC | GTS, JMH |
| 500hPa (T), 700hPa (D) | 24, 36 | 00, 12UTC | GTS, JMH |
| 700hPa (ω), 850hPa (T, A) | Analysis | 00, 12UTC | GTS |
| 24, 36 | 00, 12UTC | GTS, JMH |
| Surface (P, R, A) | 24, 36 | 00, 12UTC | GTS, JMH |
| C (East Asia) | 300hPa (Z, T, W, A) | Analysis | 00UTC | GTS |
| 500hPa (Z, T, A) | Analysis | 00, 12UTC | GTS, JMH |
| 500hPa (Z, ζ) | 48, 72 | 00, 12UTC | GTS |
| 700hPa (Z, T, D, A) | Analysis | 00, 12UTC | GTS |
| 700hPa (ω), 850hPa (T, A) | 48, 72 | 12UTC | GTS |
| 850hPa (Z, T, D, A) | Analysis | 00, 12UTC | GTS, JMH |
| Surface (P, R) | 24, 48, 72 | 00, 12UTC | GTS, JMH |
| 96, 120 | 12UTC | JMH |
| O (Asia) | 500hPa (Z, ζ) | 96, 120, 144, 168, 192 | 12UTC | GTS |
| 850hPa (T), Surface (P) |
| Q  (Asia Pacific) | 200hPa (Z, T, W), Tropopause (Z) | Analysis | 00, 12UTC | GTS |
| 250hPa (Z, T, W) | Analysis, 24 | 00, 12UTC |
| 500hPa (Z, T, W) | 24 | 00, 12UTC |
| D (N.H.) | 500hPa (Z, T) | Analysis | 12UTC | GTS |
| W  (NW Pacific) | 200hPa (streamline) | Analysis, 24, 48 | 00, 12UTC | GTS |
| 850hPa (streamline) | 00, 12UTC |
| C’’  (NW Pacific) | Ocean Wave (height, period and direction) | Analysis | 00, 12UTC | GTS, JMH |
| Ocean Wave (height, period and direction) | 12, 24, 48, 72 |
| Ocean Wave (height, period, direction and rough sea area) | 24 |
| C | Sea Surface Temperature | Daily analysis | - | JMH |
| C’2  (Asia Pacific) | Surface (P) | Analysis | 00,06,12, 18UTC | GTS, JMH |
| 24 | 00, 12UTC |
| 48 |
| Surface (Typhoon Forecast) | 12,24,48,72 | 00,06,12, 18UTC |
| 24,48,72,96,  120 | JMH |

Notes:

(a) Area

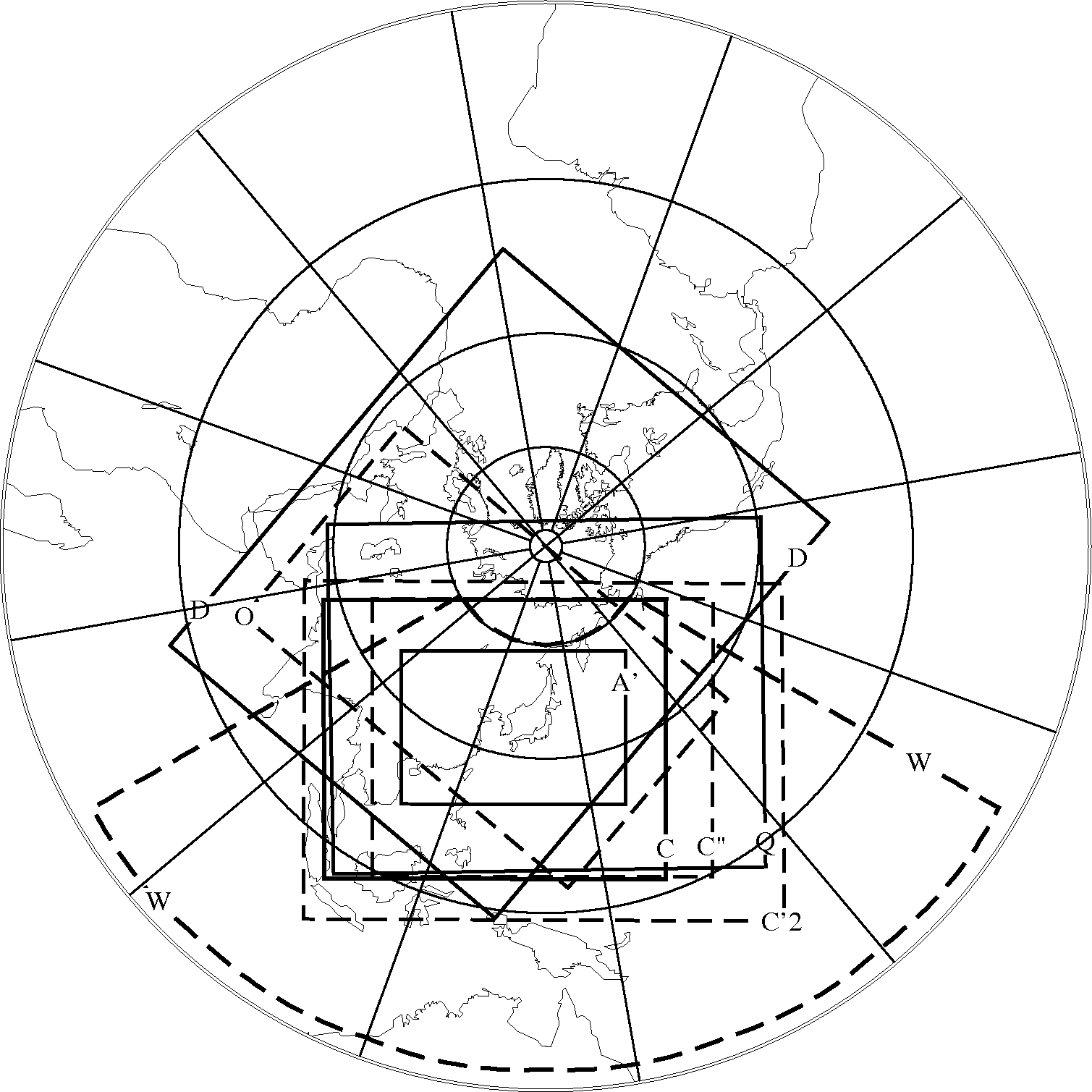
A’, C, O, Q, D, W,C’’ and C’2 are illustrated in Figure 3.1.

(b) Contents

Z: geopotential height ζ: vorticity T: temperature

D: dewpoint depression ω: vertical velocity W: wind speed by isotach

A: wind arrows P: sea level pressure R: rainfall



**Figure 3.1 Output areas for facsimile charts transmitted through GTS**

**and radio facsimile JMH**

**Table 3.2 NWP products (GSM and EPS) provided by RSMC Tokyo - Typhoon Center**

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

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

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

|  |  |  |
| --- | --- | --- |
| Model | GSM | GSM |
| Area and resolution | 5S-90N and 30E-165W,  Whole globe  0.25° × 0.25° | 5S-90N and 30E-165W,  Whole globe  0.5° × 0.5° |
| Levels and elements | Surface: U, V, T, H, P, Ps, R, Cla, Clh, Clm, Cll | 10 hPa: Z, U, V, T, H, ω  20 hPa: Z, U, V, T, H, ω  30 hPa: Z, U, V, T, H, ω  50 hPa: Z, U, V, T, H, ω  70 hPa: Z, U, V, T, H, ω  100 hPa: Z, U, V, T, H, ω  150 hPa: Z, U, V, T, H, ω  200 hPa: Z, U, V, T, H, ω, ψ, χ  250 hPa: Z, U, V, T, H, ω  300 hPa: Z, U, V, T, H, ω  400 hPa: Z, U, V, T, H, ω  500 hPa: Z, U, V, T, H, ω, ζ  600 hPa: Z, U, V, T, H, ω  700 hPa: Z, U, V, T, H, ω  800 hPa: Z, U, V, T, H, ω  850 hPa: Z, U, V, T, H, ω, ψ, χ  900 hPa: Z, U, V, T, H, ω  925 hPa: Z, U, V, T, H, ω  950 hPa: Z, U, V, T, H, ω  975 hPa: Z, U, V, T, H, ω  1000 hPa: Z, U, V, T, H, ω  Surface: U, V, T, H, P, Ps, R, Cla, Clh, Clm, Cll |
| Forecast hours | 0– 84 (every 3 hours)  90– 264 (every 6 hours) are available for 12 UTC Initial | 0– 84 (every 3 hours)  90– 264 (every 6 hours) are available for 12 UTC Initial |
| Initial times | 00, 06, 12, 18 UTC | 00, 06, 12, 18 UTC |

Notes: Z: geopotential height U: eastward wind V: northward wind

T: temperature D: dewpoint depression H: relative humidity

ω: vertical velocity ζ: vorticity ψ: stream function

χ: velocity potential P: sea level pressure Ps: pressure

R: rainfall Cla: total cloudiness Clh: cloudiness (upper layer)

Clm: cloudiness (middle layer) Cll: cloudiness (lower layer)

The prefixes µ and σ represent the average and standard deviation of ensemble prediction results respectively.

The symbols °, \*, ¶, §, ‡ and † indicate limitations on forecast hours or initial time as shown in the tables.

**Table 3.3 List of other products provided by RSMC Tokyo - Typhoon Center**

(Available at the Global Information System Center Tokyo server:

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

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

**Table 3.4 List of other products provided by RSMC Tokyo - Typhoon Center**

(Available at the Numerical Typhoon Prediction Website:

https://tynwp-web.kishou.go.jp/)

|  |  |  |
| --- | --- | --- |
| Products | Frequency | Details |
| Observation/Analysis | | |
| TC Analysis | At least  4 times/day | * Results and historical logs of RSMC Tokyo – Typhoon Center’s TC analysis conducted using satellite images (Conventional Dvorak analysis and Early-stage Dvorak analysis) |
| 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 |
| Radar | Every hour | * Radar composite imagery of the Typhoon Committee Regional Radar Network |
| Upper-Air Analysis | 4 times/day | * Upper-air analysis based on GSM initial field data * Streamlines at 850 and 200 hPa * Vertical wind shear between 200 and 850 hPa * Divergence at 200 hPa * Vorticity at 850 hPa |
| Ocean Analysis | Once/day | * Sea surface temperature and difference from 24 hours ago * Tropical cyclone heat potential and difference from 24 hours ago |
| Forecasting/NWP | | |
| 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) and a related consensus * TC track prediction of ensemble NWP models from four centers (ECMWF, NCEP, UKMO and JMA) |
| NWP Weather Maps | Twice/day | * Mean sea level pressure and 500 hPa Geopotential height (up to 72 hours at 00 UTC, up to 168 hours at 12 UTC) of deterministic NWP models from nine centers (BoM, CMA, CMC, DWD, ECMWF, KMA, NCEP, UKMO and JMA) |
| TC Activity Prediction | Twice/day | * Two- and five-day TC activity prediction maps based on ensemble NWP models from two centers (ECMWF and UKMO) and a related consensus |
| Storm Surge/Waves | | |
| Storm Surge  Forecasts | 4 times/day | * Distribution maps of storm surge for RSMC Tokyo – Typhoon Center’s TC track forecast and each of five TC track forecasts selected from GEPS ensemble members and maximum storm surge among these six TC track forecasts (up to 72 hours ahead)   + Time-series storm surge forecast charts for RSMC Tokyo – Typhoon Center’s TC track forecast and each of five TC track forecasts selected from GEPS ensemble members (up to 72 hours ahead) |
| Wave Height  Forecasts | 1. times/day | * Distribution maps of ensemble mean wave height, maximum wave height, probability of exceeding various wave heights and ensemble spread based on Wave EPS Model (up to 264 hours ahead) * Time-series charts of ensemble mean wave height with ensemble spread information and probability of exceeding various wave heights based on Wave EPS Model (up to 264 hours ahead) |

##### 3.2 Forecast at RSMC Tokyo - Typhoon Center

The RSMC Tokyo - Typhoon Center should prepare the products for numerical weather prediction shown in the WMO Manual on the Global Data-Processing and Forecasting System (GDPFS). These products should be made available to Members in real-time, and should include the following:

(i) deterministic forecast products of a high resolution global model to predict the change in large-scale atmospheric circulation patterns as well as the tropical cyclone movement and intensity

(ii) ensemble forecast products using a lower resolution version of the global model to enable estimation of uncertainties in tropical cyclone movement and intensity as well as to reduce forecast errors by using statistical methods such as ensemble mean.

The RSMC Tokyo - Typhoon Center should also prepare several statistical models for predicting the track of the tropical cyclone and apply the Dvorak method for the prediction of the intensity change of the tropical cyclone. Other relevant synoptic methods should also be applied for predicting the tropical cyclone.

The RSMC Tokyo - Typhoon Center should summarize in a consolidated form all available information and prepare the final forecasts of the tropical cyclone when it exists in the responsible area. These forecasts should include:

1. 24, 48, 72, 96 and 120-hour forecast position;
2. forecast intensity and wind distribution;
3. prognostic reasoning;
4. tendency assessment if possible.

Furthermore, the RSMC Tokyo - Typhoon Center should prepare a 24-hour ocean wave forecast once a day for the western North Pacific. Storm surge products suitable for the Typhoon Committee region should be provided by the RSMC Tokyo - Typhoon Center. A list of forecast products of the RSMC Tokyo - Typhoon Center, other than alphanumeric form, is shown in Tables 3.1 to 3.4.

##### 3.3 Operational analysis and forecast at centres of Typhoon Committee Members

The NMSs of Typhoon Committee Members are performing analysis and forecasting development and movement of tropical cyclones in the region. The final responsibility for the operational analysis and forecasting will be with the NMSs of each of the Members.

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## CHAPTER 4

**TROPICAL CYCLONE WARNINGS AND ADVISORIES**

##### 4.1 General

The responsibility for warning the human settlements on land which are threatened by a tropical cyclone rests in all cases with the NMSs. These national responsibilities are not subject to regional agreement. Therefore, only the cyclone warning systems intended for international users and exchanges among the Typhoon Committee Members are described in this chapter.

##### 4.2 Classification of tropical cyclones[[4]](#footnote-4)\*, \*\*

Classifications of tropical cyclones for the exchange of messages among the Typhoon Committee Members are given below:

(i) Low pressure area (L) Central position cannot be accurately assessed

(ii) Tropical depression (TD) Central position can be identified,

but the maximum sustained wind is 33 kt or less.

(iii) Tropical storm (TS) Maximum sustained wind is between 34 and 47 kt.

(iv) Severe tropical (STS) Maximum sustained wind is between 48 and 63 kt.

storm

(v) Typhoon (TY) Maximum sustained wind is 64 kt or more.

##### 4.3 Tropical cyclone advisories

The RSMC Tokyo - Typhoon Center should disseminate six to three-hourly analyses and forecasts of tropical cyclones in the form of bulletins (tropical cyclone advisories - see examples in Appendix [4-B](#_APPENDIX_4-B,_p.1_1)):

1. analysis of the central position, intensity and wind distribution;
2. 24, 48, 72, 96 and 120-hour forecasts of the central position;
3. forecasts of intensity and wind distribution;
4. prognostic reasoning;
5. tendency assessment if possible.

##### 4.4 Tropical cyclone warnings for the high seas

The WMO in its Manual on Marine Meteorological Services sets out the issue of weather and sea bulletins for the high seas in six parts. The first part relates to storm warnings in plain language. Areas of responsibility of each nation for issuing the storm warnings are pre-assigned. The pre-assigned forecast areas of Typhoon Committee Members were agreed upon by Regional Associations II and V (Res. 17 (IV-RA II) and Res.10 (IV-RA V)). Weather forecast areas fixed nationally by individual Typhoon Committee Members are shown in WMO Publication No. 9, Weather Reporting Volume D - Information for Shipping.

The radio stations broadcasting tropical cyclone forecasts and warnings for the benefit of the ships on the high seas in the Typhoon Committee Members are listed in Appendix [4-C](#_APPENDIX_4-C), where are shown the names of coastal radio stations with their call signs and the area covered by their bulletins. The details are shown in WMO Publication No. 9, Weather Reporting Volume D - Information for Shipping.

##### 4.5 Warnings and advisories for aviation

In accordance with the International Civil Aviation Organization (ICAO) Annex 3 - *Meteorological Service for International Air Navigation*/WMO No. 49 Technical Regulations, Volume II: Meteorological Service for International Air Navigation (WMO-No. 49 Vol. 2), tropical cyclone warnings, required for the international air navigation, are issued by designated meteorological watch offices (MWO) as SIGMET messages. SIGMET messages give a concise description in abbreviated plain language concerning the occurrence and/or expected occurrence of specified en-route weather phenomena, which may affect the safety of aircraft operations, and of the development of those phenomena in time and space. Each MWO provides information for one or more specified flight information regions (FIRs) or upper information regions (UIRs). The boundaries of the FIRs/UIRs are defined in ICAO Air Navigation Plan - Asia and Pacific Region (Doc 9673).

The content and order of elements in a SIGMET message for tropical cyclone shall be in accordance with ICAO Annex 3/WMO-No. 49 Vol. 2. The data type designator to be used in the WMO abbreviated heading of such messages shall be T1T2 = WC (WMO-No. 386, Manual on GTS refers).

The designated Tropical Cyclone Advisory Centre (TCAC) Tokyo shall monitor the development of tropical cyclones in its area of responsibility, as determined in the ICAO Air Navigation Plan - Asia and Pacific Region (Doc 9673) and issue advisory information concerning the position of the cyclone centre, its direction and speed of movement, central pressure and maximum surface wind near the centre. The tropical cyclone advisories shall be disseminated to the MWOs by TCAC Tokyo in its area of responsibility. In addition, the tropical cyclone advisories shall be disseminated to other TCACs, whose areas of responsibility may be affected, to the World Area Forecast Centres (WAFC) London and Washington, and international OPMET data banks.

The format of the tropical cyclone advisories shall be in accordance with the ICAO Annex 3/WMO-No. 49 Vol. 2. The data type designator to be used in the WMO abbreviated heading of such messages shall be T1T2 = FK (WMO-No. 386, Manual on GTS, refers).

TCAC Tokyo shall issue updated advisory information for its area of responsibility, for each tropical cyclone, as necessary, but at least every six hours.

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## CHAPTER 5

**TELECOMMUNICATIONS**

##### 5.1 General

The basic meteorological telecommunication network for the exchange of forecasts, warnings and observational data will be the Global Telecommunication System (GTS).

##### 5.2 Dissemination of data and products

The RSMC Tokyo - Typhoon Center should have adequate telecommunication facilities for the real-time collection and dissemination of data and products. A large amount of grid point data produced at the RSMC Tokyo - Typhoon Center should be exchanged between the RSMC Tokyo - Typhoon Center and NMCs where adequate circuits for this purpose exist, such as GTS and Internet.

Conventional radio facsimile broadcasts are widely used in the region, though they have some disadvantages, i.e., it takes a long time to transmit a number of charts and received charts are sometimes distorted due to noises. Nevertheless, facsimile broadcasts and reception facilities shall be retained in full operation until telecommunications via satellite is introduced to transmit products both in chart and grid point value form.

##### 5.3 Schedule for exchange of cyclone advisories

Tropical cyclone advisories issued by the RSMC Tokyo - Typhoon Center shall be transmitted at intervals of six to three hours. These messages shall be given high priority.

##### 5.4 Meteorological telecommunication network for the Typhoon Committee region

The network is shown in Appendix [5-A](#_APPENDIX_5-A) and its present status is summarized in Appendix [5-B](#_APPENDIX_5-B,_p.).

##### 5.5 Addresses, telex/cable and telephone numbers of the tropical cyclone warning centres

A list of addresses of the tropical cyclone warning centres of the Typhoon Committee Members, together with their telex/cable and telephone numbers and e-mail addresses, is given in Appendix [5-C](#_APPENDIX_5-C,_p.1_1).

##### 5.6 Abbreviated headings of tropical cyclone advisories and warnings

The abbreviated headings of meteorological messages containing tropical cyclone advisories issued by the RSMC Tokyo - Typhoon Center shall be:

1. analysis and forecast - WTPQ20 RJTD through WTPQ25 RJTD;
2. prognostic reasoning - WTPQ30 RJTD through WTPQ35 RJTD;
3. five-day track forecast - WTPQ50 RJTD through WTPQ55 RJTD;
4. numerical prediction - FXPQ20 RJTD through FXPQ25 RJTD.

The abbreviated headings of meteorological bulletins used for the exchange of tropical cyclone warnings by the Typhoon Committee Members are given in Appendix [5-D](#_APPENDIX_5-B).

##### 5.7 Exchange of information related to tropical cyclones

Collection and dissemination of observational and processed data plus warnings related to tropical cyclones at Regional Telecommunication Hubs (RTHs) and NMCs are summarized in Appendix [5-E](#_APPENDIX_5-C,_p.1).

The meanings of the symbols used in abbreviated headings in the meteorological messages transmitted to the GTS are listed in Appendix [5-F](#_APPENDIX_5-C,_p.1). The details are described in the Manual on the Global Telecommunication System (WMO Publication No. 386) and Weather Reporting Volume C - Transmissions, Chapter I Catalogue of Meteorological Bulletins (WMO Publication No. 9).

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## CHAPTER 6

**MONITORING AND QUALITY CONTROL OF DATA**

##### 6.1 Quality control of observational data

NMCs will make additional efforts to ensure that all observational data disseminated during periods of cyclone threat to the area are specifically free from errors. Wherever appropriate, verification of reports or of elements of reports will be requested of the observing station and communication channels will be kept open to facilitate this, particularly in cases where an enhanced observing programme is being carried out.

In the exchange of data during periods of cyclone threat, queries concerning reports on which there is doubt should be addressed to the relevant NMC.

Examples of message format for inquiry on doubtful and garbled reports are shown in Appendix [6-A](#_APPENDIX_6-A).

##### 6.2 Monitoring of exchange of information

Monitoring will be carried out by the RSMC Tokyo - Typhoon Center and all Typhoon Committee Members in accordance with their standard procedures. Special attention will be given to identification of deficiencies during the cyclone season in the flow of observational data and processed information relating to cyclone analysis and forecast with a view to appropriate remedial action.

The Members will inform the RSMC Tokyo - Typhoon Center of any shortcomings in the flow of data (raw and processed) and also indicate any requirements over and above those already agreed upon for tropical cyclone warning purposes.

Regular monitoring at the RSMC Tokyo - Typhoon Center should be made twice a year for appropriate periods when enhanced observations are carried out. Special monitoring may be made depending on the situation.

The procedure of regular monitoring is shown in Appendix [6-B](#_APPENDIX_6-B,_p.1).

##### 6.3 Verification

Immediately after the dissipation of a tropical cyclone of TS grade or stronger, the RSMC Tokyo - Typhoon Center should disseminate a report on the tropical cyclone in the form of bulletins to provide Members with data needed for verification, such as position and intensity of the tropical cyclone (see the example in Appendix [6-C](#_APPENDIX_6-C)):

After the end of each typhoon season, each Member will conduct the verification for its analyses and forecasts and send the report to the RSMC Tokyo - Typhoon Center in accordance with the standard procedure as shown in Appendix [6-D](#_APPENDIX_6-D). Verification sheets for positioning of the centre, prediction of movement, and analysis and forecast of intensity of a tropical cyclone are shown in Appendix [6-E](#_APPENDIX_6-E,_p.1).

The RSMC Tokyo - Typhoon Center should summarize the reports issued in a year and the results of verification conducted by Members. It should publish an annual report with respect to tropical cyclones and activities of the RSMC Tokyo - Typhoon Center and Members. The report should also identify specific areas where further co-operative research needs to be carried out by Members.

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## CHAPTER 7

**ARCHIVAL OF DATA**

##### 7.1 Data to be archived by Typhoon Committee Members

Members should establish tropical cyclone data files and information services nationally, archiving all appropriate available data.

##### 7.2 Data to be archived by RSMC Tokyo - Typhoon Center

The RSMC Tokyo - Typhoon Center should archive as far as possible tropical cyclone related data received at the centre. The data set should be produced during the period when tropical cyclone(s) is (are) in the range of 1,000 km around Typhoon Committee Members. Except for satellite imagery data, all data should be recorded by the RSMC Tokyo - Typhoon Center preferably on electronic media. A proposed list of data to be archived by the RSMC Tokyo - Typhoon Center is shown in Appendix [7-A](#_APPENDIX_7-A,_p.1).

##### 7.3 Exchange of archived data

Whenever possible Members should supply the RSMC Tokyo - Typhoon Center with all additional data requested by the RSMC Tokyo - Typhoon Center. The RSMC Tokyo - Typhoon Center should make available the archived data to Members on request for use in research, studies, investigations and training. As to distribution, similar arrangements should be made as for the TOPEX data sets which were provided by the Japan Meteorological Agency to Typhoon Committee Members (one set each) with financial assistance from UNDP. The detailed arrangements for exchange of data should be agreed upon bilaterally. Request for data sets by non-Typhoon Committee Members should be made through the WMO Secretariat upon payment of net cost (for electronic media, copying, handling, postal fees, etc.) by the requesting WMO Members.

In accordance with the directive of the WMO Executive Council (EC-XLV), (Geneva, June 1993) an international format for the archiving of tropical cyclone data is to be used by all RSMCs with activity specialization in tropical cyclones.

Complete historical data using the international format given in Appendix [7-B](#_APPENDIX_7-B,_p.1) will be made available for research applications. RSMC Tokyo - Typhoon Center will provide such data to the Director of the National Climatic Data Center (NCDC), USA.

The Tropical Cyclone Programme (TCP) Division of the WMO Secretariat has the responsibility for the maintenance of the format, including assignment of the source codes to appropriate organizations, and authorizing additions and changes.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## APPENDICES

### APPENDIX 1-A, p.1

**GUIDELINES FOR CONVERTING BETWEEN VARIOUS WIND AVERAGING PERIODS IN TROPICAL CYCLONE CONDITIONS**

This note is based on recommendations from Harper et al. (2010) and extracts from Knaff and Harper (2010), providing advice on why, when and how “wind averaging conversions” can be made.

a) Why Convert Wind Speeds?

From the observational perspective, the aim is to process measurements of the wind so as to extract an estimate of the **mean** wind at any time and its **turbulence** properties. From the forecasting viewpoint, the aim is, given a specific wind speed metric derived from a process or product, to usefully predict other metrics of the wind. Typically these needs revolve around the concept of the mean wind speed and an associated peak gust wind speed; such that the statistical properties of the expected level of wind turbulence under **different exposures** can be used to permit useful conversions **between peak gust wind speed** estimates.

b) When to Convert Wind Speeds?

Wind speed conversions to account for varying averaging periods only apply in the context of a maximum (peak gust) wind speed of a given duration observed within some longer interval. Simply measuring the wind for a shorter period of time at random will not ensure that it is always higher than the mean wind (given that there are both lulls and gusts). It is important that all wind speed values be correctly identified as an estimate of the **mean** **wind** or an estimate of a **peak** **gust**.

Once the mean wind is reliably estimated, the random effects of turbulence in producing higher but shorter-acting wind gusts, typically of greater significance for causing damage, can be estimated using a “gust factor”. In order for a gust factor to be representative, certain conditions must be met, many of which may not be exactly satisfied during a specific weather event or at a specific location:

* Wind flow is turbulent with a steady mean wind speed (**statistically stationary**);
* Constant surface features exist within the period of measurement, such that the boundary layer is in equilibrium with the underlying surface roughness (**exposure**);
* The conversion assumes the mean wind speed and the peak gust wind speed are at the same **height** (e.g. the WMO standard observation height +10 m) above the surface.

c) How to Convert Individual Point-Specific Wind Speeds

Firstly, the mean wind speed estimate *V* should be explicitly identified by its averaging period *To* in seconds, described here as *VTo* , e.g.

*V600* is a 10-min averaged mean wind estimate;

*V60* is a 1-min averaged mean wind estimate;

*V3* is a 3-sec averaged mean wind estimate.

Next, a peak gust wind speed should be additionally prefixed by the gust averaging period *τ* , and the time period over which it is observed (also termed the **reference period**), described here as *Vτ,To* , e.g.

*V60,600* is the highest 1-min mean (peak 1-min gust) within a 10-min observation period;

*V3,60* is the highest 3-sec mean (peak 3-sec gust) within a 1-min observation period.

The “gust factor” *Gτ,To* then relates as follows to the mean and the peak gust:

,

where the (true) mean wind *V* is estimated on the basis of a suitable sample, e.g. *V600* or *V3600*.

On this basis, Table 1 provides the recommended near-surface (+10 m) conversion factors *Gτ,To* between typical peak gust wind averaging periods, which are a strong function of the exposure class because the turbulence level varies depending on the surface roughness. Table 1 only provides a range of indicative exposures for typical forecasting environments and Harper et al. (2010) or WMO (2008) should be consulted for more specific advice regarding particular types of exposures - especially if it is intended to calibrate specific measurement sites to “standard exposure”.

APPENDIX 1-A, p.2

Table 1 Wind speed conversion factors for tropical cyclone conditions (after Harper et al. 2010).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Exposure at +10 m | | Reference | Gust Factor *Gτ,To* | | | | |
| Class | Description | Period | *Gust Duration τ* (s) | | | | |
| *To* (s) | *3* | *60* | *120* | *180* | *600* |
| *In-Land* | Roughly open terrain | 3600 | 1.75 | 1.28 | 1.19 | 1.15 | 1.08 |
| 600 | 1.66 | 1.21 | 1.12 | 1.09 | 1.00 |
| 180 | 1.58 | 1.15 | 1.07 | 1.00 |  |
| 120 | 1.55 | 1.13 | 1.00 |  |  |
| 60 | 1.49 | 1.00 |  |  |  |
| *Off-Land* | Offshore winds at a coastline | 3600 | 1.60 | 1.22 | 1.15 | 1.12 | 1.06 |
| 600 | 1.52 | 1.16 | 1.09 | 1.06 | 1.00 |
| 180 | 1.44 | 1.10 | 1.04 | 1.00 |  |
| 120 | 1.42 | 1.08 | 1.00 |  |  |
| 60 | 1.36 | 1.00 |  |  |  |
| *Off-Sea* | Onshore winds at a coastline | 3600 | 1.45 | 1.17 | 1.11 | 1.09 | 1.05 |
| 600 | 1.38 | 1.11 | 1.05 | 1.03 | 1.00 |
| 180 | 1.31 | 1.05 | 1.00 | 1.00 |  |
| 120 | 1.28 | 1.03 | 1.00 |  |  |
| 60 | 1.23 | 1.00 |  |  |  |
| *At-Sea* | > 20 km offshore | 3600 | 1.30 | 1.11 | 1.07 | 1.06 | 1.03 |
| 600 | 1.23 | 1.05 | 1.02 | 1.00 | 1.00 |
| 180 | 1.17 | 1.00 | 1.00 | 1.00 |  |
| 120 | 1.15 | 1.00 | 1.00 |  |  |
| 60 | 1.11 | 1.00 |  |  |  |

Some example applications of the above recommendations are:

* To estimate the expected “off-land” 3-sec peak gust in a 1-min period, multiply the estimated “off-land” mean wind speed by 1.36
* To estimate the expected “off-sea” 3-sec peak gust in a 10-min period, multiply the estimated “off-sea” mean wind speed by 1.38
* To estimate an “at-sea” 1-min peak gust in a 10-min period, multiply the estimated “at-sea” mean wind speed by 1.05

Note that it is not possible to convert from a peak gust wind speed back to a **specific** time-averaged mean wind – only to the **estimated true mean** speed. Hence to estimate the “off-sea” mean wind speed given only a peak observed gust of 1-min duration (*τ* = 60 s) measured in a 10-min period (*To* = 600 s), multiply the observed 1-min peak gust by (1/1.11) = 0.90. This does not guarantee that the estimated mean wind will be the same as the 10-min averaged wind at that time but, because the 10-min average is normally a reliable estimate of the true mean wind, it will likely be similar. In all cases, measurement systems should aim to reliably measure the mean wind speed and the standard deviation using a sample duration of not less than 10-min (WMO 2008), i.e. *V600*. Additional shorter averaging periods and the retaining of peak information should then be targeted at operational needs.

d) Converting Between Agency Estimates of Storm Maximum Wind Speed *Vmax*

This is a slightly different situation from converting a point specific wind estimate because the concept of a storm-wide maximum wind speed *Vmax* is a metric with an associated spatial context (i.e. anywhere within or associated with the storm) as well as a temporal fix context (at this moment in time or during a specific period of time). While it may be expressed in terms of any wind averaging period it remains important that it be unambiguous in terms of representing a mean wind or a peak gust. Agencies that apply the WMO standard 10-min averaged *Vmax* wind have always applied a wind-averaging conversion to reduce the maximum “sustained” 1-min wind value (a 1-min peak gust) that has been traditionally associated with the Dvorak method (Dvorak 1984, Atkinson and Holliday 1977)[[5]](#footnote-5). As noted in the previous section, it is technically not possible to convert from a peak gust back to a specific

APPENDIX 1-A, p.3

time-averaged mean wind – only to the estimated true mean wind speed. However, in Harper et al. (2010) a practical argument is made for nominal conversion between *Vmax60* and *Vmax600* values via an hourly mean wind speed reference, and the recommendations are summarised in Table 2.

It can be noted that the recommended conversion for at-sea exposure is about 5% higher than the “traditional” value of 0.88 (WMO 1993), which is more appropriate to an off-land exposure. This has special implications for the Dvorak method because “at sea” is the typical exposure of interest where such conversions have been traditionally applied.

Table 2 Conversion factors between agency estimates of maximum 1-min and maximum 10-min averaged tropical cyclone wind speed *Vmax*. (after Harper et al. 2010).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Vmax600=K Vmax60* | At-Sea | Off-Sea | Off-land | In-Land |
| *K* | 0.93 | 0.90 | 0.87 | 0.84 |

e) References

Atkinson, G.D., and C. R. Holliday, 1977: Tropical cyclone minimum sea level pressure/maximum sustained wind relationship for the Western North Pacific. *Mon. Wea. Rev.,* **105**, 421-427.

Dvorak, V.F., 1984: Tropical cyclone intensity analysis using satellite data. NOAA Tech. Rep. NESDIS 11, *National Oceanic and Atmospheric Administration*, Washington, DC, 47 pp.

Knaff, J.A. and B.A. Harper, 2010: Tropical cyclone surface wind structure and wind-pressure relationships. In: Proc. WMO IWTC-VII, *World Meteorological Organization* , Keynote 1,La Reunion, Nov.

Harper, B.A.,, J. D. Kepert, and J. D. Ginger, 2010: Guidelines for converting between various wind averaging periods in tropical cyclone conditions. *World Meteorological Organization*, TCP Sub-Project Report, WMO/TD-No. 1555.

WMO 1993: Global guide to tropical cyclone forecasting. Tropical Cyclone Programme Report No. TCP-31, *World Meteorological Organization*, WMO/TD – No. 560, Geneva.

WMO 2008: Guide to meteorological instruments and methods of observation. *World Meteorological Organization* , WMO-No. 8, 7th Ed, 681pp.

### APPENDIX 1-B, p.1

**LIST OF NAMES FOR TROPICAL CYCLONES ADOPTED**

**BY THE TYPHOON COMMITTEE FOR THE WESTERN NORTH**

**PACIFIC OCEAN AND THE SOUTH CHINA SEA**

(Valid as of 2018)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Contributed by | **I** | **II** | **III** | **IV** | **V** |
| Name | Name | Name | Name | Name |
| Cambodia | Damrey | Kong-rey | Nakri | Krovanh | Trases |
| China | Haikui | Yutu | Fengshen | Dujuan | Mulan |
| DPR Korea | Kirogi | Toraji | Kalmaegi | Surigae | Meari |
| Hong Kong, China | Kai-tak | Man-yi | Fung-wong | Choi-wan | Ma-on |
| Japan | Tembin | Usagi | Kammuri | Koguma | Tokage |
| Lao PDR | Bolaven | Pabuk | Phanfone | Champi | Hinnamnor |
| Macao, China | Sanba | Wutip | Vongfong | In-fa | Muifa |
| Malaysia | Jelawat | Sepat | Nuri | Cempaka | Merbok |
| Micronesia | Ewiniar | Mun | Sinlaku | Nepartak | Nanmadol |
| Philippines | Maliksi | Danas | Hagupit | Lupit | Talas |
| RO Korea | Gaemi | Nari | Jangmi | Mirinae | Noru |
| Thailand | Prapiroon | Wipha | Mekkhala | Nida | Kulap |
| U.S.A. | Maria | Francisco | Higos | Omais | Roke |
| Viet Nam | Son-Tinh | Lekima | Bavi | Conson | Sonca |
| Cambodia | Ampil | Krosa | Maysak | Chanthu | Nesat |
| China | Wukong | Bailu | Haishen | Dianmu | Haitang |
| DPR Korea | Jongdari | Podul | Noul | Mindulle | Nalgae |
| Hong Kong, China | Shanshan | Lingling | Dolphin | Lionrock | Banyan |
| Japan | Yagi | Kajiki | Kujira | Kompasu | Hato |
| Lao PDR | Leepi | Faxai | Chan-hom | Namtheun | Pakhar |
| Macao, China | Bebinca | Peipah | Linfa | Malou | Sanvu |
| Malaysia | Rumbia | Tapah | Nangka | Nyatoh | Mawar |
| Micronesia | Soulik | Mitag | Saudel | Rai | Guchol |
| Philippines | Cimaron | Hagibis | Molave | Malakas | Talim |
| RO Korea | Jebi | Neoguri | Goni | Megi | Doksuri |
| Thailand | Mangkhut | Bualoi | Atsani | Chaba | Khanun |
| U.S.A. | Barijat | Matmo | Etau | Aere | Lan |
| Viet Nam | Trami | Halong | Vamco | Songda | Saola |

**Replaced names**

Aere for Kodo (2002) Mangkhut for Durian (2008) Mulan for Haima (2018)

Morakot for Hanuman (2002) Atsani for Morakot (2011) Hinnamnor for Nock-ten (2018)

Matmo for Chataan (2004) Champi for Ketsana (2011)

Nuri for Rusa (2004) In-fa for Parma (2011) **Corrected spelling**

Peipah for Vamei (2004) Rai for Fanapi (2012) Megkhla to Mekkhala (2002)

Molave for Imbudo (2004) Hato for Washi (2013) Kularb to Kulap (2002)

Noul for Pongsona (2006) Ampil for Bopha (2014) Ramasoon to Rammasun (2002)

Dolphin for Yanyan (2006) Jongdari for Sonamu (2015) Vipa to Wipha (2002)

Mujigae for Maemi (2006) Barijat for Utor (2015) Kaemi to Gaemi (2008)

Mirinae for Sudal (2006) Mun for Fitow (2015) Chebi to Jebi (2008)

Lionrock for Tingting (2006) Bailu for Haiyan (2015) Noguri to Neoguri (2008)

Fanapi for Rananim (2006) Lan for Vicente (2015) Changmi to Jangmi (2008)

Pakhar for Matsa (2007) Bualoi for Rammasun (2016) Koni to Goni (2008)

Doksuri for Nabi (2007) Saudel for Soudelor (2017) SonTinh to Son-Tinh ( 2008)

Haikui for Longwang (2007) Surigae for Mujigae (2017)

Sanba for Chanchu (2008) Koguma for Koppu (2017)

Maliksi for Bilis (2008) Cempaka for Melor (2017)

SonTinh for Saomai (2008) Nyatoh for Meranti (2018)

Leepi for Xangsane (2008) Trases for Sarika (2018)

APPENDIX 1-B, p.2

**OPERATIONAL PROCEDURES FOR THE ASSIGNMENT**

**OF NAMES OF TROPICAL CYCLONES**

(a) RSMC Tokyo – Typhoon Center will assign a name each time a 4-digit identification number is to be assigned. That is, names on the Typhoon Committee list will only be given to tropical cyclones of tropical storm strength or above. Each tropical cyclone should be identified by its name followed by the 4-digit number in brackets. The same names and numbers should also be used in bulletins issued by the Tokyo Tropical Cyclone Advisory Centre under the umbrella of the International Civil Aviation Organization (ICAO) as well as in bulletins for Meteorological Area (METAREA)-XI of the Global Maritime Distress and Safety System (GMDSS) issued by both China and Japan. This would contribute to the standardization of the usage of names of tropical cyclones as was desired by the Typhoon Committee.

(b) The exchange of observational data should be promoted as much as possible in addition to what is already exchanged among the warning centres and the meteorological services in the region, to ensure that RSMC Tokyo – Typhoon Center would benefit from the best possible data and information needed for it to carry out its work.

(c) On the operation of the name list, the names will be assigned following the pre-determined order. The name would remain unchanged throughout the life history of the tropical cyclone. To avoid confusion, tropical cyclones given a name before crossing the Date Line and entering the western North Pacific should be assigned a number by RSMC Tokyo – Typhoon Center but should not be assigned a new name in the Typhoon Committee list. RSMC Honolulu Hurricane Center will continue the use of the tropical cyclone names assigned by RSMC Tokyo – Typhoon Center when tropical cyclones cross the Date Line from west to east.

(d) The names and numbers assigned by RSMC Tokyo – Typhoon Center will be used by all Typhoon Committee Members when issuing warning bulletins intended for the international community including the press, aviation and shipping.

(e) The Typhoon Committee, as the authority to maintain the list, shall review the list of names and its operation regularly at its annual sessions as the need arises.

(f) Members may request the retirement of a name from the list particularly in case of tropical cyclones causing extensive destruction or for other reasons. Such notification shall be made preferably within a year of the event. The decision to retire names should be made at the regular review at annual sessions of the Typhoon Committee.

### APPENDIX 1-C, p.1

**LIST OF ACRONYMS USED IN THE OPERATIONAL MANUAL**

**- METEOROLOGICAL COMPONENT –**

AFTN Aeronautical Fixed Telecommunication Network

AIREP Aircraft En-route Report

AMeDAS Automated Meteorological Data Acquisition System

AMV Atmospheric Motion Vector

APT Automatic Picture Transmission

ASCAT Advanced SCATterometer

ASDAR Aircraft to Satellite Data Relay

BOM Bureau of Meteorology

BUFR Binary Universal Form for the Representation of meteorological data

BUOY Report of a buoy operation

CAPPI Constant Altitude Plan Position Indicator

CMA China Meteorological Administration

CMC Canadian Meteorological Centre

CSR Clear Sky Radiance

DDN DataDirect Networks

DWD Deutscher Wetterdienst

ECMWF European Centre for Medium-Range Weather Forecasts

EPS Ensemble Prediction System

ESCAP Economic and Social Commission for Asia and the Pacific

FAX Facsimile

FTP File Transfer Protocol

GEPS Global EPS

GMS Geostationary Meteorological Satellite

GNSS Global Navigation Satellite System

GRIB General regularly distributed information in binary form

GSM Global Spectral Model

GTS Global Telecommunication System

HKO Hong Kong Observatory

HRPT High Resolution Picture Transmission

ICAO International Civil Aviation Organization

IR Infrared

JCOMM Joint Technical Commission for Oceanography and Marine Meteorology

JCSAT Japan Communications Satellite

JMA Japan Meteorological Agency

JTWC Joint Typhoon Warning Centre

KMA Korea Meteorological Administration

METER Aerodrome routine meteorological report

MPLS Multi-Protocol Label Switching

MSTP Multiple Spanning Tree Protocol

MTI Moving Target Indicator

MTSAT Multi-functional Transport Satellite

NCEP National Centers for Environmental Prediction

NESDIS National Environmental Satellite, Data and Information Service

NMC National Meteorological Centre

NMHS National Meteorological and Hydrological Service

NMS National Meteorological Service

NOAA National Oceanic and Atmospheric Administration

NWP Numerical Weather Prediction

APPENDIX 1-C, p.2

OPMET Operational Meteorological Data

PILOT Upper-wind report from a fixed land station

PNG Portable Network Graphics

PWV Precipitable Water Vapour

R/A Radar/raingauge-Analyzed precipitation

RADOB Report of ground radar weather observations

RO Radio Occultation

ROBEX Regional OPMET Bulletin Exchange

RSMC Regional Specialized Meteorological Centre

RTH Regional Telecommunication Hub

S.VISSR Stretched VISSR

SAREP Report of synoptic interpretation of cloud data obtained by a meteorological satellite

SATAID SATellite Animation and Interactive Diagnosis

SATEM Report of satellite remote upper-air soundings of pressure, temperature and humidity

SATOB Report of satellite observations of wind, surface temperature, cloud, humidity and

radiation

SHIP Report of surface observation from a sea station

SST Sea Surface Temperature

SYNOP Report of surface observation from a fixed land station

TAC Traditional Alphanumeric Code Form

TBB Temperature Black Body

TC Typhoon Committee

TCP Tropical Cyclone Programme

TCP/IP Transmission Control Protocol / Internet Protocol

TCS Typhoon Committee Secretariat

TDCF Table-Driven Code Form

TEMP Upper-level pressure, temperature, humidity and wind report from a fixed land station

TOPEX Typhoon Operational Experiment

TS Tropical Storm

UKMO United Kingdom Met Office

UNDP United Nations Development Programme

UTC Universal Time Coordinated

VIS Visible

VISSR Visible and Infrared Spin Scan Radiometer

VPN Virtual Private Network

WMO World Meteorological Organization

WV Water Vapour

### APPENDIX 2-A, p.1

**LIST OF STATIONS FROM WHICH ENHANCED**

**SURFACE OBSERVATIONS ARE AVAILABLE**

The following stations will make hourly surface observations when they are within 300 km of the centre of a tropical cyclone of TS intensity or higher:

**Cambodia**

**China**

(54): 324, 337, 342, 346, 405, 423, 436, 471, 493, 497,

511, 534, 539, 602, 618, 662, 715, 751, 753, 776,

823, 826, 836, 843, 857, 863, 929, 945

(58): 040, 141, 150, 238, 251, 265, 345, 362, 457, 472,

477, 543, 556, 569, 646, 652, 666, 752, 754, 834,

847, 911, 921, 926, 931, 944

(59): 007, 023, 046, 058, 072, 082, 087, 096, 117, 134,

209, 211, 254, 278, 287, 293, 316, 417, 431, 456,

493, 501, 632, 644, 658, 663, 673, 758, 838, 845,

855, 948, 981

**Democratic People's Republic of Korea**

(47): 003, 005, 008, 014, 016, 020, 022, 025, 028, 031,

035, 037, 039, 041, 045, 050, 052, 055, 058, 060,

061, 065, 067, 068, 069

**Hong Kong, China**

(45): 007

**Japan**

(47): 401, 407, 409, 412, 418, 420, 421, 426, 430, 570,

575, 582, 584, 590, 600, 604, 605, 610, 624, 629,

636, 648, 651, 655, 662, 675, 678, 740, 741, 746,

750, 765, 772, 778, 800, 807, 815, 817, 827, 830,

843, 887, 891, 893, 895, 909, 918, 927, 936, 945,

971, 991

**Lao People's Democratic Republic**

**Macao, China**

(45): 011

**Malaysia**

(48): 601, 615, 620, 647, 650, 657, 665

(96): 413, 421, 441, 449, 465, 471, 481, 491

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**Philippines**

(98): 132, 133, 135, 222, 232, 233, 324, 325, 328, 329,

330, 333, 336, 425, 427, 428, 429, 430, 431, 432,

434, 435, 437, 440, 444, 446, 447, 526, 531, 536,

538, 543, 546, 548, 550, 555, 558, 618, 630, 637,

642, 644, 646, 648, 653, 741, 746, 747, 748, 751,

752, 753, 755, 836, 851

**Republic of Korea**

(47): 090, 093, 095, 098, 099, 100, 101, 102, 105, 106,

108, 112, 114, 115, 119, 121, 127, 129, 130, 131,

133, 135, 136, 137, 138, 140, 143, 146, 152, 155,

156, 159, 162, 165, 168, 169, 170, 172, 174, 175,

177, 184, 185, 188, 189, 192 201, 202, 203, 211,

212, 214, 216, 217, 221, 226, 232, 235, 236, 243,

244, 245, 247, 248, 251, 252, 253, 254, 255, 257,

258, 259, 260, 261, 262, 263, 264, 266, 268, 271,

272, 273, 276, 277, 278, 279, 281, 283, 284, 285,

288, 289, 294, 295

**Thailand**

(48): 300, 303, 310, 327, 328, 329, 330, 331, 351, 352,

353, 354, 356, 357, 372, 375, 376, 378, 379, 380,

381, 383, 400, 403, 405, 407, 425, 426, 430, 431,

432, 437, 450, 453, 455, 456, 459, 462, 465, 477,

478, 480, 500, 501, 517, 532, 551, 552, 561, 564,

565, 566, 567, 568, 569, 570, 580, 583

**USA**

(91): 203, 212, 258, 317, 324, 334, 339, 348, 353, 356,

366, 367, 369, 371, 376, 378, 408, 413, 425, 434

**Viet Nam**

(48): 820, 826, 839, 845, 848, 855, 870, 877, 900, 914,

917, 918, 920

**Note:** Name, latitude, longitude and elevation of these stations are included in Weather Reporting, Volume A ‑ Observing Stations (WMO Publication No. 9).

### APPENDIX 2-B, p.1

**LIST OF STATIONS FROM WHICH ENHANCED**

**UPPER-AIR OBSERVATIONS ARE AVAILABLE**

The following stations will make 6-hourly upper-air observations when they are within 300 km of the centre of a tropical cyclone of TS intensity or higher:

**Cambodia**

**China**

(54): 511, 727, 857

(57): 083, 494, 972

(58): 150, 362, 457, 665, 847, 968

(59): 134, 316, 758, 981

**Democratic People's Republic of Korea**

(47): 041, 058

**Hong Kong, China**

(45): 004

# upper-air observations are made by wind profiler at 06 and 18 UTC normally, but

radiosondes will be launched when warranted by local wind conditions

**Japan**

(47): 401, 412, 418, 582, 600, 646, 678, 741, 778,

807, 827, 909, 918, 945, 971\*, 991\*

\* except 18 UTC

**Lao People's Democratic Republic**

**Macao, China**

**Malaysia**

(48): 601, 615, 650, 657

(96): 413, 441, 471, 481

**Philippines**

(98): 223, 433, 444, 618, 646, 573

**Republic of Korea**

(47): 102, 104, 122, 138, 158, 169, 186

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**Thailand**

(48): 327, 354, 378, 407, 431, 453, 480, 500, 551,

565, 568

**USA**

(91): 212, 334, 348, 366, 376, 408, 413

**Viet Nam**

(48): 820, 855, 900

**Note:** Name, latitude, longitude and elevation of these stations are included in Weather Reporting, Volume A ‑ Observing Stations (WMO Publication No. 9).

### APPENDIX 2-C

**LIST OF BUOY OBSERVATIONS**

**BY TYPHOON COMMITTEE MEMBERS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Member** | **Area** | **Observation Elements** | **Frequency** | **Heading in the BUFR code**  **(FM 94)** |
| Hong Kong, China | South China Sea | Air pressure and sea surface temperature | Every hour  during tropical cyclone seasons | IOBC01 VHHH  for buoys operated solely by Hong Kong, China  IOBX02 KWBC  for buoys operated under the Barometer Upgrade Scheme of the Global Drifter Programme of Data Buoy Cooperation Panel of JCOMM. |
| Japan | Western North Pacific | Air pressure, sea surface temperature, significant wave height and period | Every 3 hours  (Every hour when waves are higher than thresholds set beforehand) | SSVB01-19 RJTD |

### APPENDIX 2-D

**DISTRIBUTION OF THE RADAR STATIONS OF TYPHOON COMMITTEE MEMBERS**

radar_map

### APPENDIX 2-E, p.1

**TECHNICAL SPECIFICATIONS OF RADARS OF TYPHOON COMMITTEE MEMBERS**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member　 **China** | | | | |
| NAME OF STATION | |  | Shanghai | Wenzhou | Fuzhou | Shantou | Xis hadao |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 58367 | 58659 | 58941 | 59316 | 59981 |
|  | Location of station |  | 31° 02´ N | 27° 51´ N | 25° 59´ N | 23° 17´ N | 16° 50´ N |
|  |  | 121° 57´ E | 120° 49´ E | 119° 32´ E | 116° 44´ E | 112° 20´ E |
|  | Antenna elevation | m | 68 | 294 | 652.5 | 196.7 | 8.5 |
|  | Wave length | cm | 10.6 | 10.6 | 10.4 | 10.4 | 10.6 |
|  | Peak power of transmitter | kW | 500 | 500 | 500 | 500 | 500 |
|  | Pulse length | µ s | 1 | 3.0 | 1.0 | 1 | 3 |
|  | Sensitivity minimum of  receiver |  | -110 | -110 | -119 | -109 | -110 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) | deg | 2.0 | 2.0 | 2.0 | 1.2 | 2.0 |
|  |
|  | Detection range | km | 600 | 600 |  |  |  |
|  | Scan mode in observation |  | 1  2  3 | 1  2  3 | 1  2  3 | 1  2  3 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 2 | 2 | 1 | 1 | 2 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 2 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1 | 1 | 1 | 1 | 1 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Name of the Member **Democratic People’s Republic of Korea** | | | | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Pyongyang |  |  |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 47058 |  |  |  |  |
|  | Location of station |  | 39° 02´ N |  |  |  |  |
|  |  | 125° 47´ E |  |  |  |  |
|  | Antenna elevation | m | 90 |  |  |  |  |
|  | Wave length | cm | 3.2 |  |  |  |  |
|  | Peak power of transmitter | kW | 150 |  |  |  |  |
|  | Pulse length | µ s | 1, 2 |  |  |  |  |
|  | Sensitivity minimum of  receiver |  | -132 |  |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 44 |  |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 300 |  |  |  |  |
|  | Scan mode in observation |  | 1  2  3 |  |  |  |  |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 2 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 |  |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1 |  |  |  |  |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 |  |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Hong Kong, China** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Tai Mo Shan | Tate’s Cairn |  |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 45009 | 45010 |  |  |  |
|  | Location of station |  | 22° 25´ N | 22° 21´ N |  |  |  |
|  |  | 114° 07´ E | 114° 13´ E |  |  |  |
|  | Antenna elevation | m | 968 | 582 |  |  |  |
|  | Wave length | cm | 10.6 | 10.3 |  |  |  |
|  | Peak power of transmitter | kW | 650 | 650 |  |  |  |
|  | Pulse length | µ s | 1.0/2.0 | 1.0/2.0 |  |  |  |
|  | Sensitivity minimum of  receiver |  | -117 | -114 |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 0.9(H)  0.9(V) | 0.9 |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 500 | 500 |  |  |  |
|  | Scan mode in observation |  | 2 | 2 |  |  |  |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  (Continuous) | 3  (Continuous) |  |  |  |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.4

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Japan - 1** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Sapporo  /Kenashiyama | Kushiro  /Kombumori | Hakodate  /Yokotsudake | Sendai | Akita |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 47415 | 47419 | 47432 | 47590 | 47582 |
|  | Location of station |  | 43° 08´ N | 42° 58´ N | 41° 56´ N | 38° 16´ N | 39° 43´ N |
|  |  | 141° 01´ E | 144° 31´ E | 140° 47´ E | 140° 54´ E | 140° 06´E |
|  | Antenna elevation | m | 749.0 | 121.5 | 1141.7 | 98.2 | 55.3 |
|  | Wave length | cm | 5.61 | 5.61 | 5.60 | 5.61 | 5.59 |
|  | Peak power of transmitter | kW | 250 | 250 | 250 | 250 | 250 |
|  | Pulse length | µ s | 1.1/2.6 | 1.1/2.6 | 1.1/2.6 | 1.0/2.6 | 1.1/2.6 |
|  | Sensitivity minimum of  receiver |  | -109/-112 | -110/-113 | -108/-111 | -108/-111 | -108/-112 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.1(H)  1.1(V) | 1.1(H)  1.0(V) | 1.0(H)  1.0(V) | 1.0(H)  1.0(V) | 1.0 (H)  0.9 (V) |
|  | deg |
|  |  |
|  | Detection range | km | 400 | 400 | 400 | 400 | 400 |
|  | Scan mode in observation |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1 | 1 | 1 | 1 | 1 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.5

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Japan - 2** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Tokyo  /Kashiwa | Niigata  /Yahikoyama | Fukui  /Tojimbo | Nagano  /Kurumayama | Shizuoka  /Makinohara |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 47695 | 47572 | 47705 | 47611 | 47659 |
|  | Location of station |  | 35° 52´ N | 37° 43´ N | 36° 14´ N | 36° 06´ N | 34° 45´ N |
|  |  | 139° 58´ E | 138° 49´ E | 136° 09´ E | 138° 12´ E | 138° 08´E |
|  | Antenna elevation | m | 74.0 | 645.0 | 107.0 | 1937.1 | 186.0 |
|  | Wave length | cm | 5.59 | 5.61 | 5.59 | 5.64 | 5.66 |
|  | Peak power of transmitter | kW | 250 | 250 | 250 | 250 | 250 |
|  | Pulse length | µ s | 1.1/2.6 | 1.0/2.5 | 1.1/2.7 | 1.0/2.6 | 1.1/2.6 |
|  | Sensitivity minimum of  receiver |  | -109/-113 | -109/-113 | -109/-113 | -110/-114 | -110/-113 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.0(H)  1.0(V) | 1.0(H)  1.0(V) | 1.1(H)  1.0(V) | 1.1(H)  1.0V) | 1.1(H)  1.1(V) |
|  | deg |
|  |  |
|  | Detection range | km | 400 | 400 | 400 | 400 | 400 |
|  | Scan mode in observation |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1 | 1 | 1 | 1 | 1 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.6

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Japan - 3** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Nagoya | Osaka  /Takayasuyama | Matsue  /Misakayama | Hiroshima  /Haigamine | Murotomisaki |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 47636 | 47773 | 47791 | 47792 | 47899 |
|  | Location of station |  | 35° 10´ N | 34° 37´ N | 35° 33´ N | 34° 16´ N | 33° 15´ N |
|  |  | 136° 58´ E | 135° 39´ E | 133° 06´ E | 132° 36´ E | 134° 11´E |
|  | Antenna elevation | m | 73.1 | 497.6 | 553.0 | 746.9 | 198.9 |
|  | Wave length | cm | 5.60 | 5.61 | 5.61 | 5.59 | 5.60 |
|  | Peak power of transmitter | kW | 250 | 250 | 250 | 250 | 250 |
|  | Pulse length | µ s | 1.1/2.6 | 1.0/2.6 | 1.1/2.6 | 1.1/2.7 | 1.1/2.6 |
|  | Sensitivity minimum of  receiver |  | -108/-112 | -108/-112 | -109/-112 | -109/-111 | -109/-113 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.0(H)  1.0(V) | 1.1(H)  1.1(V) | 1.0(H)  1.1(V) | 1.1(H)  1.0(V) | 1.0(H)  1.0(V) |
|  | deg |
|  |  |
|  | Detection range | km | 400 | 400 | 400 | 400 | 400 |
|  | Scan mode in observation |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1 | 1 | 1 | 1 | 1 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Japan - 4** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Fukuoka  /Sefuriyama | Tanegashima  /Nakatane | Naze  /Funchatoge | Okinawa  /Itokazu | Ishigakijima  /Omotodake |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 47806 | 47869 | 47909 | 47937 | 47920 |
|  | Location of station |  | 33° 26´ N | 30° 38´ N | 28° 24´ N | 26° 09´ N | 24° 26´ N |
|  |  | 130° 21´ E | 130° 59´ E | 129° 33´ E | 127° 46´ E | 124° 11´E |
|  | Antenna elevation | m | 982.7 | 290.5 | 318.8 | 208.2 | 533.5 |
|  | Wave length | cm | 5.60 | 5.61 | 5.66 | 5.61 | 5.61 |
|  | Peak power of transmitter | kW | 250 | 250 | 250 | 250 | 250 |
|  | Pulse length | µ s | 1.1/2.7 | 1.1/2.7 | 1.1/2.6 | 1.0/2.5 | 1.1/2.7 |
|  | Sensitivity minimum of  receiver |  | -109/-112 | -108/-112 | -109/-113 | -109/-113 | -107/-111 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.0(H)  1.0(V) | 1.1(H)  1.0(V) | 1.1(H)  1.0(V) | 1.0(H)  1.0(V) | 1.1(H)  1.1(V) |
|  | deg |
|  |  |
|  | Detection range | km | 400 | 400 | 400 | 400 | 400 |
|  | Scan mode in observation |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1 | 1 | 1 | 1 | 1 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.8

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Macao, China** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | TAIPA  GRANDE | ZHUHAI-MACAO  RADAR |  |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 45011 |  |  |  |  |
|  | Location of station |  | 22.1599N | 22.0240N |  |  |  |
|  |  | 113.5624E | 113.3756E |  |  |  |
|  | Antenna elevation | m | 183 | 250 |  |  |  |
|  | Wave length | cm | 3.4 | ~10 |  |  |  |
|  | Peak power of transmitter | kW | 200 | > 800 |  |  |  |
|  | Pulse length | µ s | 0.4, 0.8, 1.0, 2.0 | 0.5, 1.57, 4.5 |  |  |  |
|  | Sensitivity minimum of  receiver |  | -113 | -114 for 4.5us  -111 for 1.57us |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1° | < +/- 0.01° |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 128 | 230/460 |  |  |  |
|  | Scan mode in observation |  | 3 | 3 |  |  |  |
|  | 1. Fixed elevation |  |
|  | 2. CAPPI |  |
|  | 3. Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3 | 3 |  |  |  |
|  | cyclone is within range of detection) | |
|  | 1. Hourly |  |
|  | 2. 3-hourly |  |
|  | 3. Others |  |
|  | PRESENT STATUS |  | 2 | 1 |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.9

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Malaysia - 1** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Alor Star | Kota Bharu | Kuala Lumpur (Sepang) | Kuala Lumpur (Subang) | Kluang |
|  |
|  | SPECIFICATIONS |  |  |  |  |  |  |
|  | Index number |  | 48603 | 48615 | 48650 | 48647 | 48672 |
|  | Location of station |  | 6° 11´ N | 6° 10´ N | 2° 51´ N | 3° 07´ N | 2° 01´ N |
|  |  | 100° 24´ E | 102° 17´ E | 101° 40´ E | 103° 13´ E | 103° 19´E |
|  | Antenna elevation | m | 24 | 33 | 25 | 32 | 113 |
|  | Wave length | cm | 10 | 10 | 10 | 10 | 10 |
|  | Peak power of transmitter | kW | 650 | 650 | 750 | 650 | 650 |
|  | Pulse length | µ s | 0.8 and 2 | 2 | 1 and 3 | 2 | 0.8 and 2 |
|  | Sensitivity minimum of  receiver |  | -110 (.8 μs)  -113 (2 μs) | -113 | -110 (.8 μs)  -115 (3 μs) | -113 | -110 (.8 μs)  -113 (2 μs) |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 2 | 2 | 1 | 2 | 2 |
|  | deg |
|  |  |
|  | Detection range | km | 400 | 400 | 400 | 400 | 400 |
|  | Scan mode in observation |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 2 | 2 | 1 | 2 | 2 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  (every 10 mins) | 3  (every 10 mins) | 3  (every 5 mins) | 3  (every 10 mins) | 3  (every 10 mins) |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1  (from May 2005) | 1 | 1 | 1 | 1  (from Apr 2005) |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.10

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Malaysia - 2** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Kuantan | Butterworth | Kuching | Bintulu | Kota Kinabalu |
|  |
|  | SPECIFICATIONS |  |  |  |  |  |  |
|  | Index number |  | 48657 | 48602 | 96413 | 96441 | 96471 |
|  | Location of station |  | 3° 47´ N | 5° 28´ N | 1° 29´ N | 3° 13´ N | 5° 56´ N |
|  |  | 103° 13´ E | 100° 23´ E | 110° 20´ E | 113° 04´ E | 116° 03´E |
|  | Antenna elevation | m | 32 | 20 | 57 | 151 | 27 |
|  | Wave length | cm | 10 | 10 | 5 | 5 | 5 |
|  | Peak power of transmitter | kW | 650 | 650 | 250 | 250 | 250 |
|  | Pulse length | µ s | 2 | 2 | 2 | 2 | 2 |
|  | Sensitivity minimum of  receiver |  | -113 | -113 | -113 | -113 | -113 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 2 | 2 | 1.6 | 1.6 | 1.6 |
|  | deg |
|  |  |
|  | Detection range | km | 400 | 400 | 250 | 250 | 250 |
|  | Scan mode in observation |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  (every 10 mins) | 3  (every 10 mins) | 3  (every 10 mins) | 3  (every 10 mins) | 3  (every 10 mins) |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.11

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Malaysia - 3** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Sandakan |  |  |  |  |
|  |
|  | SPECIFICATIONS |  |  |  |  |  |  |
|  | Index number |  | 96491 |  |  |  |  |
|  | Location of station |  | 5° 54´ N |  |  |  |  |
|  |  | 118° 04´ E |  |  |  |  |
|  | Antenna elevation | m | 28 |  |  |  |  |
|  | Wave length | cm | 5 |  |  |  |  |
|  | Peak power of transmitter | kW | 250 |  |  |  |  |
|  | Pulse length | µ s | 2 |  |  |  |  |
|  | Sensitivity minimum of  receiver |  | -113 |  |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.6 |  |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 250 |  |  |  |  |
|  | Scan mode in observation |  | 2 |  |  |  |  |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 2 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 |  |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  (every 10 mins) |  |  |  |  |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 |  |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.12

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Philippines - 1** | | | | |
| NAME OF STATION | |  | Aparri | Virac | Mactan | Guiuan | Subic |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 98231 | 98447 | 98646 | 98558 |  |
|  | Location of station |  | 18° 31’ 36.36’’ N | 13° 37’ 47.18’’ N | 10° 19’ 20.80’’ N | 11° 02’ 48.48’’ N | 14° 49’ 19.44’’ N |
|  |  | 121° 38’ 08.58’’ E | 124° 20’ 02.57’’ E | 123° 58’ 48.47’’ E | 125° 45’ 19.55’’ E | 120° 21’ 49.68’’E |
|  | Antenna elevation | m | 39 | 39 | 26 | 39 | 40 |
|  | Wave length | cm | 10.52 | 10.52 | 5.33 | 10.52 | 10.4 |
|  | Peak power of transmitter | kW | 10 | 10 | 250 | 10 | 850 |
|  | Pulse length | µ s | 2& 100 – intensity mode  1 @ 50 – Doppler mode | 2 & 100 – intensity mode  1 @ 50 – Doppler mode | 2.0, 1.0, 0.8, 0.4 | 2 & 100 – intensity mode  1 @ 50 – Doppler mode | 2.0, 1.0, 0.8, 0.4 |
|  | Sensitivity minimum of  receiver |  | -114 | -114 | -114 | -114 | -114 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.8 | 1.8 | 1.0 | 1.8 | 1.83 |
|  | deg |
|  |  |
|  | Detection range | km | 440 | 440 | 250 | 440 | 480 |
|  | Scan mode in observation |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 2 | 1 | 2 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 2 | 2 | 1 | 2 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3 (constantly tracking) | 3 (constantly tracking) | 3 | 3 (constantly tracking) | 3 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.13

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Philippines - 2** | | | | |
| NAME OF STATION | |  | Baler | Hinatuan | Tampakan | Ilo-Ilo | Tagaytay |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 98333 | 98755 |  | 98637 |  |
|  | Location of station |  | 15° 44’ 57.72’’ N | 08° 22’ 02.37’’ N | 06° 25’ 03.81’’ N | 10° 46’ 20.08’’ N | 14° 09’ 31.28’’ N |
|  |  | 121° 37’ 55.37’’ E | 126° 20’ 18.73’’ E | 125° 01’ 51.41’’ E | 122° 34’ 45.08’’ E | 121° 01’ 12.49’’ E |
|  | Antenna elevation | m | 15 | 26 | 26 | 26 | 35 |
|  | Wave length | cm | 10.68 | 10.78 | 10.4 | 10.44 | 5.34 |
|  | Peak power of transmitter | kW | 600 | 850 | 850 | 850 | 250 |
|  | Pulse length | µ s | 2.0, 1.0, 0.8, 0.4 | 2.0, 1.0, 0.8, 0.4 | 2.0, 1.0, 0.8, 0.4 | 3.0, 1.0, 0.8, 0.4 | 2.0, 1.0, 0.8, 0.4 |
|  | Sensitivity minimum of  receiver |  | -114 | -114 | -114 | -114 | -114 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.83 | 1.3 | 1.3 | 1.3 | 1.0 |
|  | deg |
|  |  |
|  | Detection range | km | 480 | 480 | 480 | 480 | 250 |
|  | Scan mode in observation |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3 | 3 | 3 | 3 | 3 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 2 (for replacement) | 1 | 2 (for replacement of gears) | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.14

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Philippines - 3** | | | | |
| NAME OF STATION | |  | Basco | Quezon, Palawan |  |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 98135 |  |  |  |  |
|  | Location of station |  | 20° 25’ 14.87’’ N | 9° 13’ 50.01’’ N |  |  |  |
|  |  | 121° 57’ 54.76’’ E | 118° 00’ 20.09’’ E |  |  |  |
|  | Antenna elevation | m | 15 | 26 |  |  |  |
|  | Wave length | cm | 5.33 | 5.35 |  |  |  |
|  | Peak power of transmitter | kW | 250 | 250 |  |  |  |
|  | Pulse length | µ s | 2.0, 1.0, 0.8, 0.4 | 2.0, 1.0, 0.8, 0.4 |  |  |  |
|  | Sensitivity minimum of  receiver |  | -114 | -114 |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.0 | 1.0 |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 250 | 250 |  |  |  |
|  | Scan mode in observation |  | 2 | 2 |  |  |  |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3 | 3 |  |  |  |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 (no communication link to central office but we get data via FTP) | 1 |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational (for research etc.) | |

APPENDIX 2-E, p.15

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Republic of Korea - 1** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Gosan | Seongsan | Gangneung | Oseongsan | Baengnyeong-do |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 47185 | 47188 | 47105 | 47144 | 47102 |
|  | Location of station |  | 33° 17´ N | 33° 23´ N | 37° 49´ N | 36° 00´ N | 37° 58´ N |
|  |  | 126° 09´ E | 126° 52´ E | 128° 51´ E | 126° 47´ E | 124° 37´ E |
|  | Antenna elevation | m | 101 | 68 | 99 | 231 | 188 |
|  | Wave length | Cm | 10.9 | 10.8 | 10.5 | 10.9 | 5.3 |
|  | Peak power of transmitter | kW | 750 | 750 | 750 | 750 | 250 |
|  | Pulse length | µ s | 1.0; 4.5 | 1.0; 4.5 | 1.0; 4.5 | 1.0; 4.5 | 1.0; 2.0 |
|  | Sensitivity minimum of  receiver |  | -112 | -112 | -112 | -112 | -108 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
|  | deg |
|  |  |
|  | Detection range | km | 250  (volume)  500 (lowest tilt) | 250, 500 | 280, 500 | 240, 480 | 256, 480 |
|  | Scan mode in observation |  | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 |
|  | 1. Fixed elevation |  |
|  | 2. CAPPI |  |
|  | 3. Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  (continuous) | 3  (continuous) | 3  (continuous) | 3  (continuous) | 3  (continuous) |
|  | cyclone is within range of detection) | |
|  | 1. Hourly |  |
|  | 2. 3-hourly |  |
|  | 3. Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.16

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Republic of Korea - 2** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Jindo | Gwangdeok -san | Myeonbong -san | Gwanaksan | Gudeoksan |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 47175 | 47094 | 47148 | 47116 | 47160 |
|  | Location of station |  | 34° 28´ N | 38° 07´ N | 36° 10´ N | 37° 26´ N | 35° 07´ N |
|  |  | 126° 19´ E | 127° 26´ E | 128° 59´ E | 126° 57´ E | 128° 59´ E |
|  | Antenna elevation | m | 497 | 1064 | 1127 | 640 | 547 |
|  | Wave length | cm | 10.3 | 10.3 | 5.3 | 11 | 11 |
|  | Peak power of transmitter | kW | 750 | 750 | 250 | 850 | 850 |
|  | Pulse length | µ s | 1.0; 2.5 | 1.0; 4.5 | 0.83; 2.5 | 1.0; 4.5 | 1.0; 4.5 |
|  | Sensitivity minimum of  receiver |  | -112 | -112 | -112 | -114 | -114 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
|  | deg |
|  |  |
|  | Detection range | km | 240, 480 | 250, 500 | 200 | 240, 480 | 240, 480 |
|  | Scan mode in observation |  | 1, 2 | 1, 2 | 1, 2 | 1, 2 | 1, 2 |
|  | 1. Fixed elevation |  |
|  | 2. CAPPI |  |
|  | 3. Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 | 2 | 2 | 2 | 2 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  (continuous) | 3  (continuous) | 3  (continuous) | 3  (continuous) | 3  (continuous) |
|  | cyclone is within range of detection) | |
|  | 1. Hourly |  |
|  | 2. 3-hourly |  |
|  | 3. Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) |  |

APPENDIX 2-E, p.17

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Republic of Korea - 3** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Korean Aviation Meteorological Agency |  |  |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 47113 |  |  |  |  |
|  | Location of station |  | 37° 28´ N |  |  |  |  |
|  |  | 126° 21´ E |  |  |  |  |
|  | Antenna elevation | m | 145 |  |  |  |  |
|  | Wave length | cm | 5.32 |  |  |  |  |
|  | Peak power of transmitter | kW | 250 |  |  |  |  |
|  | Pulse length | µ s | 1.0; 2.0 |  |  |  |  |
|  | Sensitivity minimum of  receiver |  | -110 |  |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 0.53 |  |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 30, 480 |  |  |  |  |
|  | Scan mode in observation |  | 1, 2 |  |  |  |  |
|  | 1. Fixed elevation |  |
|  | 2. CAPPI |  |
|  | 3. Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 2 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 |  |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  (continuous) |  |  |  |  |  |
|  | cyclone is within range of detection) | |  |
|  | 1. Hourly |  |
|  | 2. 3-hourly |  |
|  | 3. Others |  |
|  | PRESENT STATUS |  | 1 |  |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |  |

APPENDIX 2-E, p.18

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Singapore** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Changi |  |  |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 48698 |  |  |  |  |
|  | Location of station |  | 1° 22´ N |  |  |  |  |
|  |  | 103° 59´ E |  |  |  |  |
|  | Antenna elevation | m | 35 |  |  |  |  |
|  | Wave length | cm | 10 |  |  |  |  |
|  | Peak power of transmitter | kW | 750 |  |  |  |  |
|  | Pulse length | µ s | 1 or 3 |  |  |  |  |
|  | Sensitivity minimum of  receiver |  | -110 |  |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | < 1 |  |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 480 |  |  |  |  |
|  | Scan mode in observation |  | 2 |  |  |  |  |
|  | 1. Fixed elevation |  |
|  | 2. CAPPI |  |
|  | 3. Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 |  |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  (continuous) |  |  |  |  |  |
|  | cyclone is within range of detection) | |  |
|  | 1. Hourly |  |
|  | 2. 3-hourly |  |
|  | 3. Others |  |
|  | PRESENT STATUS |  | 1 |  |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |  |

APPENDIX 2-E, p.19

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Thailand - 1** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Mahong Son | Chiang Rai | Chiang Mai | Sakol Nakon | Phitsanulok |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 48300 | 48303 | 48327 | 48356 | 48378 |
|  | Location of station |  | 19° 18´ N | 19° 55´ N | 18° 47´ N | 17° 09´ N | 16° 46´ N |
|  |  | 97° 50´ E | 99° 50´ E | 98° 59´ E | 104° 08´ E | 100° 16´ E |
|  | Antenna elevation | m | 292 | 440 | 337 | 198 | 56 |
|  | Wave length | cm | 3 | 5 | 5 | 5 | 5 |
|  | Peak power of transmitter | kW | 200 | 300 | 300 | 300 | 300 |
|  | Pulse length | µ s | 0.5&1 | 0.8&2 | 0.8&2 | 0.8&2 | 0.8&2 |
|  | Sensitivity minimum of  receiver |  | -90 | -110 | -110 | -110 | -110 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 2 | 1.0 | 1.0 | 1.0 | 1.0 |
|  | deg |
|  |  |
|  | Detection range | km | 120 | 240 | 240 | 240 | 240 |
|  | Scan mode in observation |  | 2, 3 | 2, 3 | 2, 3 | 2,3 | 2, 3 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1, 3 | 1, 3 | 1, 3 | 1, 3 | 1, 3 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.20

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Thailand - 2** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Khon Khaen | Samut  Songkram | Ubol | Surin | Hua Hin |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 48381 | 48402 | 48407 | 48432 | 48475 |
|  | Location of station |  | 16° 27´ N | 13° 24´ N | 15° 14´ N | 14° 53´ N | 12° 35´ N |
|  |  | 102° 47´ E | 100° 01´ E | 105° 01´ E | 103° 29´ E | 99° 57´ E |
|  | Antenna elevation | m | 215 | 29 | 155 | 175 | 30 |
|  | Wave length | cm | 5 | 5 | 5 | 5 | 10 |
|  | Peak power of transmitter | kW | 300 | 300 | 300 | 300 | 500 |
|  | Pulse length | µ s | 0.8&2 | 0.812 | 0.8&2 | 0.8&2 | 0.8&2 |
|  | Sensitivity minimum of  receiver |  | -106 | -110 | -108 | -106 | -106 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.0 | 1.0 | 1.0 | 1.0 | 2.1 |
|  | deg |
|  |  |
|  | Detection range | km | 240 | 240 | 240 | 240 | 240 |
|  | Scan mode in observation |  | 2, 3 | 2, 3 | 2, 3 | 2, 3 | 2, 3 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1, 3 | 1, 3 | 1, 3 | 1, 3 | 1, 3 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.21

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Thailand - 3** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Rayong | Chumporn | Ranong | Surat Thani | Phuket |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 48478 | 48517 | 48532 | 48551 | 48565 |
|  | Location of station |  | 12° 38´ N | 10° 29´ N | 9° 47´ N | 9° 08´ N | 8° 08´ N |
|  |  | 101° 21´ E | 99° 11´ E | 98° 36´ E | 99° 09´ E | 99° 19´ E |
|  | Antenna elevation | m | 32 | 28 | 45 | 33 | 281 |
|  | Wave length | cm | 5 | 5 | 3 | 5 | 5 |
|  | Peak power of transmitter | kW | 300 | 300 | 200 | 300 | 300 |
|  | Pulse length | µ s | 0.882 | 0.8&2 | 0.5&1 | 0.8&2 | 0.852 |
|  | Sensitivity minimum of  receiver |  | -115 | -110 | -90 | -110 | -106 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.0 | 1.0 | 2 | 1.0 | 1.0 |
|  | deg |
|  |  |
|  | Detection range | km | 240 | 240 | 120 | 240 | 240 |
|  | Scan mode in observation |  | 2, 3 | 2, 3 | 2, 3 | 2, 3 | 2, 3 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1, 3 | 1, 3 | 1, 3 | 1, 3 | 1, 3 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 2 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

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|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Thailand - 4** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Trang | Sathing Pra  (Songkla) | Narathiwat |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 48567 | 48568 | 48583 |  |  |
|  | Location of station |  | 7° 31´ N | 7° 26´ N | 6° 25´ N |  |  |
|  |  | 99° 37´ E | 100° 27´ E | 101° 49´ E |  |  |
|  | Antenna elevation | m | 40 | 30 | 29 |  |  |
|  | Wave length | cm | 3 | 5 | 5 |  |  |
|  | Peak power of transmitter | kW | 200 | 300 | 300 |  |  |
|  | Pulse length | µ s | 0.5&1 | 0.8&2 | 0.5&1 |  |  |
|  | Sensitivity minimum of  receiver |  | -90 | -115 | -110 |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 2 | 1.0 | 1.0 |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 120 | 240 | 120 |  |  |
|  | Scan mode in observation |  | 2, 3 | 2, 3 | 2, 3 |  |  |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 | 1 |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1, 3 | 1, 3 | 1, 3 |  |  |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 |  |  |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.23

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **USA** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Guam | Kwajalein |  |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 91217 | 91366 |  |  |  |
|  | Location of station |  | 13° 33´ N | 8° 44´ N |  |  |  |
|  |  | 144° 50´ E | 167° 44´ E |  |  |  |
|  | Antenna elevation | m | 110 | 30 |  |  |  |
|  | Wave length | cm | 10.6 | 10.0 |  |  |  |
|  | Peak power of transmitter | kW | 750 | 500 |  |  |  |
|  | Pulse length | µ s | 1.57/ 4.5 | 0.8 |  |  |  |
|  | Sensitivity minimum of  receiver |  | -113 | -107 |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 0.96 | 1.0 |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 399 | 250 |  |  |  |
|  | Scan mode in observation |  | 2 | 2 |  |  |  |
|  | 1. Fixed elevation |  |
|  | 2. CAPPI |  |
|  | 3. Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 2 |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 | 1 |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 3  6-minute  continuous | 3  continuous |  |  |  |  |
|  | cyclone is within range of detection) | |  |
|  | 1. Hourly |  |
|  | 2. 3-hourly |  |
|  | 3. Others |  |
|  | PRESENT STATUS |  | 1 | 1 |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |  |

APPENDIX 2-E, p.24

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Viet Nam – 1** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Phu Lien | Viet Tri | Vinh | Tam Ky | Nha Trang |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  | 48826 | 48813 | 48845 | 48833 | 48877 |
|  | Location of station |  | 20.48 °N | 21.18 °N | 18.40 °N | 15.34 °N | 12.13 °N |
|  |  | 106.38 °E | 105.25 °E | 105.41 °E | 108.28 °E | 109.12 °E |
|  | Antenna elevation | m | 140 | 56 | 27 | 40 | 52 |
|  | Wave length | cm | 5.3 | 5.3 | 5.3 | 5.6 | 5.6 |
|  | Peak power of transmitter | kW | 250 | 250 | 250 | 250 | 250 |
|  | Pulse length | µ s | 2 | 2 | 2 | 0.8;2.0 | 0.8;2.0 |
|  | Sensitivity minimum of  receiver |  | -110 | -110 | -110 | -113 | -113 |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1.1 | 1.1 | 1.1 | 1 | 1 |
|  | deg |
|  |  |
|  | Detection range | km | 384 | 384 | 384 | 480 | 480 |
|  | Scan mode in observation |  | 1,3 | 1,3 | 1,3 | 1,2,3 | 1,2,3 |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 2 | 2 | 2 | 1 | 1 |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1, 3 | 1, 3 | 1, 3 | 1, 3 | 1, 3 |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 | 1 | 1 | 1 | 1 |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

APPENDIX 2-E, p.25

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Name of the Member **Viet Nam - 2** | | | | |
|  |  |  |  |  |  |  |  |
| NAME OF STATION | |  | Nha Be |  |  |  |  |
|  |
|  | SPECIFICATIONS | Unit |  |  |  |  |  |
|  | Index number |  |  |  |  |  |  |
|  | Location of station |  | 10° 49´ N |  |  |  |  |
|  |  | 106° 43´ E |  |  |  |  |
|  | Antenna elevation | m | 25 |  |  |  |  |
|  | Wave length | cm | 5.6 |  |  |  |  |
|  | Peak power of transmitter | kW | 250 |  |  |  |  |
|  | Pulse length | µ s | 0.4; 0.8; 2.0 |  |  |  |  |
|  | Sensitivity minimum of  receiver |  | -122 |  |  |  |  |
|  | dBm |
|  | Beam width  (Width of over -3dB  antenna gain of maximum) |  | 1 |  |  |  |  |
|  | deg |
|  |  |
|  | Detection range | km | 480 |  |  |  |  |
|  | Scan mode in observation |  | 1, 2, 3 |  |  |  |  |
|  | 1.Fixed elevation |  |
|  | 2.CAPPI |  |
|  | 3.Manually controlled |  |
|  | DATA PROCESSING |  |  |  |  |  |  |
|  | MTI processing |  | 1 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Doppler processing |  | 1 |  |  |  |  |
|  | 1.Yes, 2.No |  |
|  | Display |  | 1 |  |  |  |  |
|  | 1.Digital, 2.Analog |  |
|  | OPERATION MODE (When tropical | | 1, 3 |  |  |  |  |
|  | cyclone is within range of detection) | |
|  | 1.Hourly |  |
|  | 2.3-hourly |  |
|  | 3.Others |  |
|  | PRESENT STATUS |  | 1 |  |  |  |  |
|  | 1.Operational |  |
|  | 2.Not operational(for research etc.) | |

### APPENDIX 2-F

**SCHEDULE OF HIMAWARI OBSERVATIONS AND DISSEMINATIONS**

1. **Observations**

Himawari observations are as follows:

1. full-disk observations are made every 10 minutes;
2. target area observations are made every 2.5 minutes in addition to the full-disk observations;
3. **HimawariCloud (Internet cloud service)**

JMA distributes full-spec imagery derived from the Himawari-series satellites via an Internet cloud service, HimawariCloud. See the following webpage for details.

http://www.data.jma.go.jp/mscweb/en/himawari89/cloud\_service/cloud\_service.html

1. **HimawariCast (communication satellite dissemination service)**

JMA operates the HimawariCast service which disseminates primary sets of imagery from the Himawari-series satellites via a communication satellite, See the following webpage for details.

http://www.data.jma.go.jp/mscweb/en/himawari89/himawari\_cast/himawari\_cast.html

1. **Internet Service for National Meteorological and Hydrological Services (NMHSs)**

Besides the above services, JMA provides satellite imagery through various methods.

[JMA real-time satellite imagery webpage]

http://www.jma.go.jp/en/gms/

[MSC (Meteorological Satellite Center) real-time satellite imagery webpage]

http://www.data.jma.go.jp/mscweb/data/himawari/

[SATAID (Satellite Animation and Interactive Diagnosis) Service]

<http://www.wis-jma.go.jp/cms/sataid/>

[JDDS (JMA Data Dissemination Service)]

http://www.data.jma.go.jp/mscweb/en/himawari89/JDDS\_service/JDDS\_service.html

### APPENDIX 2-G, p.1

**SATELLITE IMAGERY RECEIVING FACILITIES**

**AT TYPHOON COMMITTEE MEMBERS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Member** | **Station** | | | **Himawari**  **1. Himawari　Cloud**  **2. Himawari　Cast** | **NOAA**  **1. HRPT**  **2. APT** | **Meteosat**  **1. P-DUS** |
| Cambodia |  |  | | 1, 2 |  |  |
| China | Beijing  Shanghai  Shenyan  Guangzhou Cheng-chou  Cheng-tu  Lan-chou  Kunming  Changsha  Nanjing  Harbin | (39.9°N, 116.4°E)  (31.1°N, 121.4°E)  (41.8°N, 123.6°E)  (23.1°N, 113.3°E)  (34.7°N, 113.7°E)  (31.2°N, 114.0°E)  (36.1°N, 103.9°E)  (25.0°N, 102.7°E)  (28.2°N, 113.1°E)  (32.0°N, 118.8°E)  (45.8°N, 126.8°E) | | 1 | 1, 2  2 |  |
| Democratic People's Republic of Korea | Pyongyang | (39.0°N, 125.8°E) | |  | 1 |  |
| Hong Kong, China\* | Kowloon | (22.3°N, 114.2°E) | | 1, 2 | 1 |  |
| Japan | Minamitorishima | (24.3°N, 154.0°E) | | 2 |  |  |
| Lao People's Democratic Republic |  | |  | 2 |  |  |
| Macao, China\* | Macao | | (22.2°N, 113.5°E) | 1, 2 | 1 |  |
| Malaysia | Petaling Jaya | | (3.1°N, 101.7°E) | 1, 2 | 1 |  |
| Philippines | Quezon City  Cagayan de Oro City  Pasay City  Cebu | | (14.7°N, 121.0°E)  (8.5°N, 124.6°E)  (14.5°N, 121.0°E)  (10.3°N, 124.0°E) | 1, 2 | 1 |  |

\*Hong Kong, China receives AQUA (MODIS), NPP(CrIs, VIIRS, ATMS), FY-2 (S-VISSR), and TERRA (MODIS).

\* Macao, China receives FY-2D, FY-2E (S-VISSR) Stretched VISSR.

APPENDIX 2-G, p.2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Member** | **Station** | | **Himawari**  **1. Himawari　Cloud**  **2. Himawari　Cast** | **NOAA**  **1. HRPT**  **2. APT** | **Meteosat**  **1. P-DUS** |
| Republic of Korea\* | Seoul  Incheon Int. Airport  Munsan  Seosan  Pusan  Pusan Kimhae Air  Kwangju  Taejon  Kangnung  Cheju  Taegu  Taegu/Air Traffic  Chonju  Chongju  Ullung-Do  Mokpo  Chunchon  Masan  Tongyong  Inchon  Huksando  Suwon  Sokcho  Pohang  Kunsan  Baengnyeong-do | (37.6°N, 127.0°E)  (37.3°N, 126.3°E)  (37.9°N, 126.8°E)  (36.8°N, 126.5°E)  (35.1°N, 129.0°E)  (35.2°N, 126.9°E)  (35.2°N, 126.9°E)  (36.4°N, 127.4°E)  (37.5°N, 130.9°E)  (33.5°N, 126.5°E)  (35.9°N, 128.6°E)  (35.9°N, 128.7°E)  (35.8°N, 127.2°E)  (36.6°N, 127.4°E)  (37.5°N, 130.9°E)  (34.8°N, 126.4°E)  (37.9°N, 127.7°E)  (35.2°N, 128.6°E)  (34.9°N, 128.4°E)  (37.5°N, 126.6°E)  (34.7°N, 125.5°E)  (37.3°N, 127.0°E)  (38.3°N, 128.6°E)  (36.0°N, 129.4°E)  (36.0°N, 126.7°E)  (37.9°N, 124.6°E) | 1 | 1  1 | 1 |
| Singapore\* | Changi Airport | (1.4°N, 104.0°E) | 1 | 1 | 1 |
| Thailand | Bangkok | (13.7°N, 100.6°E) | 1, 2 | 1 |  |
| USA | Guam | (13.4°N, 144.6°E) | 1 | 1 |  |
| Viet Nam | Hanoi  Ho Chi Ming City | (21.0°N, 105.5°E)  (10.5°N, 106.4°E) | 1, 2 | 2  2 |  |

\* Republic of Korea receives AQUA (MODIS, AIRS, AMSU, AMSR-E), FY-1 (CHRPT) and TERRA (MODIS).

\* Singapore receives AQUA (MODIS), FY2B (S-VISSR), FY-1 (CHRPT) and TERRA (MODIS).

### APPENDIX 2-H

**LIST OF SAREP REPORTS**

**ISSUED BY TYPHOON COMMITTEE MEMBERS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Member** | **Frequency** | **Heading in the BUFR code (FM 94)** | **Issuance Condition** |
| RSMC Tokyo – Typhoon Center | 8 times/day | IUCC10 RJTD | 1. When a tropical cyclone of TS intensity or higher is located in the responsible area of the RSMC Tokyo - Typhoon Center; 2. When a tropical depression existing in the responsible area is forecasted to have an intensity of TS or higher within 24 hours; or 3. When an area of wind speed of 34 knots or higher caused by a tropical cyclone is forecasted to be in the responsible area within 24 hours. |
| Hong Kong, China | 8 times/day | IUCC01 VHHH  IUCC02 VHHH  IUCC03 VHHH  IUCC04 VHHH | When a tropical cyclone is located within 10N to 30N and 105E to 125E. |

### APPENDIX 2-I

**RECONNAISSANCE FLIGHTS**

**CONDUCTED BY TYPHOON COMMITTEE MEMBERS**

HKO conducts dropsonde reconnaissance flights for selected tropical cyclones over the northern part of the South China Sea. Data is disseminated in BUFR format through GTS circuit.

### APPENDIX 2-J

**TROPICAL CYCLONE PASSAGE REPORT FORM**

**TROPICAL CYCLONE PASSAGE REPORT FORM**

TC Name (RSMC No.) 0 0

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Station/ buoy/ship Number | | Minimum Sea Level Pressure | | Maximum Sustained Wind | | Peak Gust | | Rainfall | |
|
|  | Time Observed | (10-min ave.) | Time Observed |  | Time Observed | Amount | Date |
| hPa | (UTC) | m/sec | (UTC) | m/sec | (UTC) | mm | Observed |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

### APPENDIX 4-A

**CLASSIFICATIONS OF TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC**

**INTERNALLY USED BY MEMBERS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Maximum sustained winds  (knots) | ≤33 | 34 - 47 | 48 - 63 | ≥ 64 | | |
| Typhoon Committee  (10 min) | Tropical Depression (TD) | Tropical  Storm (TS) | Severe Tropical  Storm (STS) | Typhoon (TY) | | |
| China  (2 min) | TD | TS | STS | 64 - 80  TY | 81 - 99  Severe Typhoon (STY) | ≥ 100  Super Typhoon (Super TY) |
| Hong Kong,  China  (10 min) | TD | TS | STS | 64 - 80  TY | 81 - 99  Severe Typhoon (ST) | ≥ 100  Super Typhoon (Super T) |
| Japan  (10 min) | TD | TS | STS | 64 - 84  TY | 85 - 104  Very Strong TY | ≥ 105  Violent TY |
| U.S.  (1 min) | TD | TS | | 64 - 129  TY |  | ≥ 130  Super TY |

### APPENDIX 4-B, p.1

**EXAMPLES OF ADVISORIES ISSUED FROM RSMC TOKYO - TYPHOON CENTER**

**RSMC Tropical Cyclone Advisory**

WTPQ20 RJTD 271200

RSMC TROPICAL CYCLONE ADVISORY

NAME TY 0815 JANGMI (0815)

ANALYSIS

PSTN 271200UTC 21.3N 124.4E GOOD

MOVE NW 13KT

PRES 910HPA

MXWD 115KT

GUST 165KT

50KT 120NM

30KT 240NM

FORECAST

24HF 281200UTC 24.7N 121.1E 75NM 70%

MOVE NW 12KT

PRES 950HPA

MXWD 080KT

GUST 115KT

48HF 291200UTC 27.3N 121.3E 160NM 70%

MOVE N 07KT

PRES 980HPA

MXWD 060KT

GUST 085KT

72HF 301200UTC 29.3N 124.9E 220NM 70%

MOVE ENE 09KT

PRES 994HPA

MXWD 035KT

GUST 050KT =

**RSMC Guidance for Forecast**

D20080927152930

FXPQ20 RJTD 271200

RSMC GUIDANCE FOR FORECAST

NAME TY 0815 JANGMI (0815)

PSTN 271200UTC 21.3N 124.4E

PRES 910HPA

MXWD 115KT

FORECAST BY GLOBAL MODEL

TIME PSTN PRES MXWD

(CHANGE FROM T=0)

T=06 22.0N 124.0E -002HPA +001KT

T=12 23.0N 123.4E 000HPA +004KT

T=18 24.5N 122.7E -003HPA +013KT

T=24 25.0N 121.3E +009HPA -005KT

:

T=72 29.5N 125.8E +040HPA -039KT

T=78 29.5N 127.6E +039HPA -040KT

T=84 29.7N 129.7E +039HPA -039KT

T=90 ///// ////// /////// //////=

APPENDIX 4-B, p.2

**RSMC Prognostic Reasoning**

WTPQ30 RJTD 250600

RSMC TROPICAL CYCLONE PROGNOSTIC REASONING

REASONING NO. 4 FOR STS 0815 JANGMI (0815)

1.GENERAL COMMENTS

REASONING OF PROGNOSIS THIS TIME IS SIMILAR TO PREVIOUS ONE.

POSITION FORECAST IS MsAINLY BASED ON NWP AND PERSISTENCY.

2.SYNOPTIC SITUATION

NOTHING PARTICULAR TO EXPLAIN.

3.MOTION FORECAST

POSITION ACCURACY AT 250600 UTC IS FAIR.

STS WILL DECELERATE FOR THE NEXT 24 HOURS.

STS WILL MOVE NORTHWEST FOR THE NEXT 48 HOURS THEN MOVE GRADUALLY TO WEST-NORTHWEST.

4.INTENSITY FORECAST

STS WILL BE GRADED UP TO TY WITHIN 24 HOURS.

STS WILL DEVELOP BECAUSE SPIRAL CLOUD BANDS HAVE BECOME WELL ORGANIZED AND CYCLONE WILL STAY IN HIGH SST AR

EA.

FI-NUMBER WILL BE 4.5 AFTER 24 HOURS.=

**RSMC Tropical Cyclone Advisory for Five-day Track Forecast**

WTPQ50 RJTD 190000

RSMC TROPICAL CYCLONE ADVISORY

NAME TY 0910 VAMCO (0910) UPGRADED FROM STS

ANALYSIS

PSTN 190000UTC 17.3N 157.5E GOOD

MOVE E SLOWLY

PRES 970HPA

MXWD 065KT

GUST 095KT

50KT 40NM

30KT 180NM NORTHEAST 120NM SOUTHWEST

FORECAST

24HF 200000UTC 18.0N 156.9E 70NM 70%

MOVE ALMOST STATIONARY

PRES 960HPA

MXWD 075KT

GUST 105KT

48HF 210000UTC 18.7N 156.5E 110NM 70%

MOVE ALMOST STATIONARY

PRES 950HPA

MXWD 080KT

GUST 115KT

72HF 220000UTC 21.2N 155.9E 160NM 70%

MOVE N 06KT

PRES 950HPA

MXWD 080KT

GUST 115KT

96HF 230000UTC 24.5N 154.4E 240NM 70%

MOVE NNW 09KT

120HF 240000UTC 29.2N 153.5E 375NM 70%

MOVE N 12KT =

### APPENDIX 4-C

**STATIONS BROADCASTING CYCLONE WARNINGS**

**FOR SHIPS ON THE HIGH SEAS**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Station | | | | Call sign of coastal radio station | | Area covered | |
| Member | | Station | |
| China | Shanghai | | XSG | | Bohai Sea, Huanghai Sea, Donghai Sea, Shanghai Port, Taiwan Straits and sea around Taiwan province | |
|  | Tianjin | | XSZ | | North and Central Huanghai Sea and Bohai Sea | |
|  | Guangzhou | | XSQ | | Taiwan Straits, Bashi Channel, Nanhai Sea and Beibu Wan Gulf | |
| Hong Kong, China | Hong Kong | | Broadcast via NAVTEX on 518 kHz\* | | Waters inside the boundary line: 30N 105E to 30N 125E to 10N 125E, to 10N 105E, to 30N 105E | |
| Japan | Hokkaido | | JNL | | Hokkaido area | |
|  | Shiogama | | JNN | | Sendai area | |
|  | Yokohama | | JGC | | Tokyo area | |
|  | Nagoya | | JNT | | Nagoya area | |
|  | Kobe | | JGD | | Kobe area | |
|  | Hiroshima | | JNE | | Hiroshima area | |
|  | Niigata | | JNV | | Niigata area | |
|  | Maizuru | | JNC | | Maizuru area | |
|  | Moji | | JNR | | Fukuoka area | |
|  | Kagoshima | | JNJ | | Kagoshima area | |
|  | Okinawa | | JNB | | Okinawa area | |
| Malaysia | Port Penang  Labuan  Miri | | LY 3010  OA 3010  OE 3010 | | Strait of Malacca\*  South China Sea\*  South China Sea\*  \*within 300nm from station | |
| Philippines | Manila | | DZR, DZG, DSP, DZD, DZF, DFH, DZO, DZN, DZS | | Pacific waters inside the boundary line: 25N 120E to 25N 135E, to 5N 135E, to 5N 115E, to 15N 115E, to 21N 120E, to 20N 120E | |
|  | San Miguel | | NPO | | North Pacific waters east of 160E; Philippine Sea, Japan Sea, Yellow Sea, East China Sea, South China Sea | |
| Republic of Korea | Seoul | | HLL | | East Sea, Yellow Sea, Jeju, Chusan, Nagasaki, and Kagoshima areas | |
| Thailand | Bangkok | | HSA | | Gulf of Thailand, West coast of Southern Thailand, Strait of Malacca and South China Sea | |
| U.S.A. | Honolulu, Hawaii | | KMV-99 | | Pacific Ocean | |
| Viet Nam | Dannang | | XVT 1-2 | | Basco Gulf, Blendong Sea and Gulf of Thailand | |
|  | Halphong | | XVG 5, 9 | | *ditto* | |
|  | Ho Chi Minh Ville | | XVS 1, 3, 8 | | *ditto* | |
|  | Nha Trang | | XVN 1, 2 | | *ditto* | |

\*Coast station VRX closed on 1 October 2006.

### APPENDIX 5-A

**METEOROLOGICAL TELECOMMUNICATION NETWORK**

**FOR THE TYPHOON COMMITTEE**

Seoul

Beijing

Tokyo

Washington

Bangkok

Offenbach

Singapore

Pyongyang

Macao

Manila

Hong Kong

Hanoi

Phnom Penh

Vientiane

Kuala Lumpur

Circuits of Main Telecommunication Network

RTH Main regional circuits

Regional circuits

NMC

Inter-regional circuits

### APPENDIX 5-B, p.1

**PRESENT OPERATIONAL STATUS**

**OF THE METEOROLOGICAL TELECOMMUNICATION NETWORK**

**FOR THE TYPHOON COMMITTEE REGION**

1. Main Telecommunication Present Operational Status

Network

Beijing - Tokyo Cable (MPLS), TCP/IP

Beijing 16 Mbps/Tokyo 10 Mbps

Beijing - Offenbach Cable (MPLS), TCP/IP

Beijing 16 Mbps/Offenbach 50 Mbps

Washington - Tokyo Cable (MPLS), TCP/IP

Washington 50 Mbps/Tokyo 10 Mbps

2. Main regional circuit

Tokyo - Bangkok Cable (MPLS), TCP/IP

Tokyo 2 Mbps/Bangkok 128 kbps

3. Regional circuits

Bangkok - Beijing 64 kbps leased line

CMACast (Satellite broadcast)

Bangkok - Hanoi 64 kbps leased line, FTP protocol

Bangkok – Hong Kong Internet, FTP protocol

Bangkok - Phnom Penh Internet (VPN), TCP/IP

Bangkok - Vientiane Cable (DDN), 64 kbps, FTP protocol

and Internet, FTP protocol

Beijing - Hanoi 64 kbps leased line,

CMACast (Satellite broadcast)

Beijing - Hong Kong Cable (MSTP), 4 Mbps TCP/IP

CMACast (Satellite broadcast)

Beijing - Macao 2Mbps leased line

CMACast (Satellite broadcast)

Beijing - Pyongyang 64 kbps leased line,;

CMACast (Satellite broadcast)

Beijing - Seoul Cable (MPLS), TCP/IP

Beijing 16 Mbps/Seoul 4 Mbps

Beijing - Vientiane CMACast (Satellite broadcast)

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Hong Kong - Macao Internet (VPN)

Tokyo - Hong Kong Cable (MPLS), TCP/IP

Tokyo 2 Mbps/Hong Kong 1 Mbps

Tokyo - Seoul Cable (MPLS), TCP/IP

Tokyo 10 Mbps/Seoul 4 Mbps

4. Inter-regional circuits

Bangkok - Kuala Lumpur Cable (MPLS), TCP/IP 64 kbps

Bangkok - Singapore Cable (MPLS), TCP/IP 64 kbps

Bangkok - Offenbach Internet, FTP protocol

Tokyo - Manila Cable (MPLS), TCP/IP

Tokyo 2 Mbps/Manila 64 kbps

5. RTH radio broadcast

Bangkok 1 FAX

Tokyo 1 FAX

6. Satellite broadcast

Operated by China:

Asiasat-4 (122.2°E) Operational observations, warnings,

NWP products, satellite image and fax

distribution

Operated by Japan:

HimawariCast Operational satellite image, NWP

(JCSAT-2, 154°E) products, in-situ observation data and

ASCAT ocean surface wind data

distribution

7. Internet Cloud Service

Operated by Japan:

HimawariCloud Operational satellite image in full

resolutions and bands

### APPENDIX 5-C, p.1

**LIST OF ADDRESSES, TELEX/CABLE AND TELEPHONE NUMBERS**

**OF THE TROPICAL CYCLONE WARNING CENTERS IN THE REGION**

**Centre Mailing address Telex/cable, Telephone, fax numbers**

**Cambodia**

Attn. Mr Ly Chana

Deputy Director Norodom Boulevard Tel.: (+855) 15 913081

Department of Agricultural Fax: (+855) 23 26345

Hydraulics and Hydrometeorology

Attn. Mr Hun Kim Hak Pochentong Tel/Fax: (+855) 23 66193

Chief of Cambodian National 66192 NMC

66191 Airport

**China**

National Meteorological Center No. 46 Zhongguancun Tel.: (+86) (10) 5899 5809

China Meteorological Adm. Nandajie, Beijing 100081 Cable: 2894

(Director: Bi Baogui) Fax: (+86) (10) 6217 2956

E-mail: bibg@cma.gov.cn

**Democratic People's Republic of Korea**

Mr Ko Sang Bok Oesong-dong Telex: 38022 TCT KP

Director Central District Tel.: (+850) (2) 321 4539

Central Forecast Research Insitute Fax: (+850) (2) 381 4410

State Hydrometeorological Adm.

**Hong Kong, China**

Central Forecasting Office 134A Nathan Road

Hong Kong Observatory Tsim Sha Tsui Tel.: (+852) 2926 8371

(Attn. Mr. L.S. Lee) Kowloon (Office hours)

Hong Kong, China (+852) 2368 1944

(24 hours)

Fax: (+852) 2311 9448

(24 hours)

E-mail: lslee@hko.gov.hk

**Japan**

Forecast Division 1-3-4 Otemachi Telex: 2228080 METTOKJ

Forecast Department Chiyoda-ku (24 hours)

Japan Meteorological Agency Tokyo 100-8122 Tel.: (+81) (3)3211 8303

(Director: Y. Kajihara) (00 - 09 UTC on weekdays)

(+81) (3) 3211 7617

(24 hours)

Fax: (+81) (3) 3211 8303

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**Lao People's Democratic Republic**

Ministry of Agriculture P.O. Box 811 Telex: 4306 ONU VTELS

and Forestry, Department of Vientiane Cable: UNDEVPRO VIENTIANE

Meteorology and Hydrology

**Macao, China**

Meteorological and P.O. Box 93 Tel.: (+853) 88986173

Geophysical Bureau Macao, China Fax: (+853) 28850773

(Director: Tam Vai Man) E-mail: meteo@smg.gov.mo

**Malaysia**

Malaysian Meteorological Dep. Jalan Sultan Tel.: (+60) (3) 7967 8116

(Central Forecast Office, 46667 Petaling Jaya (+60) (3) 7967 8119

Director: Mr. Saw Bun Liong) Selangor Fax: (+60) (3) 7955 0964

Malaysia E-mail: cfo@met.gov.my

**Philippines**

Esperanza O. Cayanan Ph.D. WFFC Bldg., Telex: 66682 WXMLA PN

Weather Services Chief BIR Road, Diliman, Tel.: (+63) (2) 922 1996

Weather Division, PAGASA Quezon City 1100 Cable: 66682 WX MLA

Fax: (+63) (2) 922 5287

(24 hours)

**T C S**

Secretary: Yu Jixin Avenida de 5 de Outubro Tel: (853) 8 8010531

Coloane, Macau Fax: (853) 8 8010530

E-mail:

yujx@typhooncommittee.org

**Republic of Korea**

National Typhoon Center

Korea Meteorological Administration

(Director: Deok Hwan JEONG)

2 Seoseongro 810-gil, Namwon-eup, Seogwipo, Tel.: (+82) (70) 7850-6351

Jeju, 63614, Republic of Korea Fax: (+82) (64) 805-0368

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**Thailand**

Thai Meteorological Department 4353 Sukhumvit Road Tel.: (+66) (2) 366 6325

Bangkok 10260 Fax.: (+66) (2) 399 4020

(Director-General: Mr. Wanchai Sakudomchai) E-mail: tmd\_inter@tmd.go.th

Weather Forecast Bureau 4353 Sukhumvit Road

Thai Meteorological Department Bangkok 10260

Tel&Fax: (+66) (2) 399 4001

(Director: Dr. Sugunyanee Yavinchan) E-mail: sugunyanee@hotmail.com

Telecommunications and Information 4353 Sukhumvit Road Tel.: (+66) (2) 399 4555

Technology Bureau Bangkok 10260 Fax: (+66) (2) 398 9861

Thai Meteorological Department

(Acting Director : Mr. Wirat Woranut) E-mail: tmd\_inter@tmd.go.th

**USA**

National Weather Service 3232 Hueneme Road Tel.: (+1-671) 472 0944

(Genevieve Miller, Meteorologist Barrigada Fax: (+1-671) 472 7405

in charge) Guam 96913

RSMC Honolulu 2525 Correa Road Suite Tel.: (+1-808) 973-5272

(Director: Raymond Tanabe) 250 Honolulu, HI 96822 Fax: (+1-808) 973-5271

**Viet Nam**

Forecast Division 4 Dan Thai Than Tel.: (+84) (4) 264020

Forecast Department Hanoi Fax: (+84) (4) 254278

Hydro-Meteorological Service

(Director: Nguyan Cong Thanh)

### APPENDIX 5-D

**ABBREAVIATED HEADINGS FOR THE TROPICAL CYCLONE WARNINGS**

**Member Abbreviated WMO Communication Headings**

**Cambodia**

**China** WTPQ20 BABJ

**Democratic People's**

**Republic of Korea**

**Hong Kong, China** WTPQ20 VHHH, WTSS20 VHHH

**Japan** WTPQ20 RJTD, WTPQ21 RJTD, WTPQ22 RJTD, WTPQ23 RJTD, WTPQ24 RJTD, WTPQ25 RJTD

**Lao People's**

**Democratic Republic**

**Macao, China** For domestic dissemination only and WTMU40 VMMC

**Malaysia** For domestic dissemination only

**Philippines** WTPH20 RPMM, WTPH21 RPMM

**Republic of Korea** WTKO20 RKSL

**Singapore** WTSR20 WSSS

**Thailand** WTTH20 VTBB

**USA** WTPQ31 - 35 PGUM

**Viet Nam** WTVS20 VNNN

### APPENDIX 5-E, p.1

**COLLECTION AND DISTRIBUTION OF INFORMATION**

**RELATED TO TROPICAL CYCLONES**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Receiving station | | | | | | | | | | |
| Type of Data | Heading | | TD | BJ | BB | HH | MM | SL | NN | KK | IV | PP | MC |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Enhanced | SNCI30 | BABJ | BJ | O | BJ | BJ | TD | TD | BJ | BB | BB | BB |  |
| surface | SNHK20 | VHHH | HH | HH | BJ | O |  | TD | BB | BB | BB | BB | HH |
| observation | SNJP20 | RJTD | O | TD | TD | TD |  | TD | BB | BB | BB | BB |  |
|  | SNKO20 | RKSL | SL | TD | TD | TD |  | O | BB | BB | BB | BB |  |
|  | SNLA20 | VLIV | BB | BB | IV |  |  |  | BB | BB | O | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | SNMS20 | WMKK | BB | BB | KK | BJ |  |  | BB | O | BB | BB |  |
|  | SNMU40 | VMMC |  | MC | BJ | BJ |  | TD | BB | BB | BB | BB | O |
|  | SNPH20 | RPMM | MM | TD | TD | TD | O | TD | BB | BB | BB | BB |  |
|  | SNTH20 | VTBB | BB | TD | O | TD |  | TD | BB | BB | BB | BB |  |
|  | SNVS20 | VNNN | BB |  | NN | BJ |  |  | O | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Enhanced | USCI01 | BABJ | BJ | O | BJ | BJ | TD | TD | BJ | BB | BB | BB |  |
| upper-air | USCI03 | BABJ | BJ | O | BJ | BJ | TD | TD | BJ | BB | BB | BB |  |
| observation | USCI05 | BABJ | BJ | O | BJ | BJ | TD | TD | BJ | BB | BB | BB |  |
|  | USCI07 | BABJ | BJ | O | BJ | BJ | TD | TD | BJ | BB | BB | BB |  |
|  | USCI09 | BABJ | BJ | O | BJ | BJ | TD | TD | BJ | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | UKCI01 | BABJ | BJ | O | BJ | BJ |  | TD | BJ | BB | BB | BB |  |
|  | ULCI01 | BABJ | BJ | O | BJ | BJ |  | TD | BB | BB | BB | BB |  |
|  | ULCI03 | BABJ | BJ | O | BJ | BJ |  | TD | BB | BB | BB | BB |  |
|  | ULCI05 | BABJ | BJ | O | BJ | BJ |  | TD | BB | BB | BB | BB |  |
|  | ULCI07 | BABJ | BJ | O | BJ | BJ |  | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ULCI09 | BABJ | BJ | O | BJ | BJ |  | TD | BJ | BB | BB | BB |  |
|  | UECI01 | BABJ | BJ | O | BJ | BJ |  | TD | BB | BB | BB | BB |  |
|  | USHK01 | VHHH | HH | HH | BJ | O | TD | TD | BB | BB | BB | BB | HH |
|  | UKHK01 | VHHH | HH | HH | BJ | O |  | TD | BB | BB | BB | BB | HH |
|  | ULHK01 | VHHH | HH | HH | BJ | O |  | TD | BB | BB | BB | BB | HH |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | UEHK01 | VHHH | HH | HH | BJ | O |  | TD | BB | BB | BB | BB | HH |
|  | USJP01 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | UKJP01 | RJTD | O | TD | TD | TD |  | TD | BB | BB | BB | BB |  |
|  | ULJP01 | RJTD | O | TD | TD | TD |  | TD | BB | BB | BB | BB |  |
|  | UEJP01 | RJTD | O | TD | TD | TD |  | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | USKO01 | RKSL | SL | TD | TD | TD | TD | O | BB | BB | BB | BB |  |
|  | UKKO01 | RKSL | SL | TD | TD | TD |  | O | BB | BB | BB | BB |  |
|  | ULKO01 | RKSL | SL | TD | TD | TD |  | O | BB | BB | BB | BB |  |
|  | UEKO01 | RKSL | SL | TD | TD | TD |  | O | BB | BB | BB | BB |  |
|  | USMS01 | WMKK | BB | TD | KK | TD | TD | TD | BB | O | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | UKMS01 | WMKK | BB | TD | KK | TD | TD | TD | BB | O | BB | BB |  |
|  | ULMS01 | WMKK | BB | TD | KK | TD | TD | TD | BB | O | BB | BB |  |
|  | UEMS01 | WMKK | BB | TD | KK | TD | TD | TD | BB | O | BB | BB |  |
|  | USPH01 | RPMM | MM | TD | TD | TD | O | TD | BB |  | BB | BB |  |
|  | UKPH01 | RPMM | MM | TD | TD | TD | O | TD | BB |  | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ULPH01 | RPMM | MM | TD | TD | TD | O | TD | BB |  | BB | BB |  |
| *Continued to* | UEPH01 | RPMM | MM | TD | TD | TD | O | TD | BB |  | BB | BB |  |
| *the next page* | USTH01 | VTBB | BB | TD | O | TD | TD | TD | BB | BB | BB | BB |  |

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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Receiving station | | | | | | | | | | |
| Type of Data | Heading | | TD | BJ | BB | HH | MM | SL | NN | KK | IV | PP | MC |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Enhanced | UKTH01 | VTBB | BB | TD | O | TD |  | TD | BB | BB | BB | BB |  |
| Upper-air | ULTH01 | VTBB | BB | TD | O | TD |  | TD | BB | BB | BB | BB |  |
| observation | UETH01 | VTBB | BB | TD | O | TD |  | TD | BB | BB | BB | BB |  |
|  | USVS01 | VNNN | BB | TD | NN | TD | TD | TD | O | BB | BB | BB |  |
|  | UKVS01 | VNNN | BB | TD | NN | TD |  | TD | O | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ULVS01 | VNNN | BB | TD | NN | TD | TD | TD | O | BB | BB | BB |  |
|  | UEVS01 | VNNN | BB | TD | NN | TD | TD | TD | O | BB | BB | BB |  |
|  | URPA10 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | URPA11 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | URPA12 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | URPA14 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | URPN10 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | UZPA13 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | UZPN13 | KNHC | \* |  | TD | TD |  | TD | BB | BB | BB | BB |  |
|  | UZPN13 | KWBC | \* | TD | TD | TD |  | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | UZPN13 | PGTW | \* | TD | TD | TD |  | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Enhanced | SNVB20 | VTBB |  |  | O |  |  |  | BB | BB | BB | BB |  |
| ship | SNVB20 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
| observation | SNVD20 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | SNVE20 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | SNVX20 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | SNVB21 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | SNVD21 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | SNVE21 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | SNVX21 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | SNVX20 | RPMM | MM | TD | TD | TD | O | TD | BB |  | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | SNVX20 | VHHH | HH | HH | BJ | O | TD | TD | BB | BB | BB | BB | HH |
|  | SNVX20 | VNNN | BB | TD | NN | TD |  | TD | O | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Enhanced | SBCI30 | BABJ | BJ | O | BJ | TD | TD | TD | BJ | BB | BB | BB |  |
| radar | SCCI30 | BABJ |  | O | BJ | BJ |  |  | BB | BB | BB | BB |  |
| observation | SBCI60 | BCGZ |  | O | BJ |  |  |  | BJ | BB | BB | BB |  |
|  | SCCI60 | BCGZ | HH | O | BJ |  |  |  | BB | BB | BB | BB |  |
|  | SBHK20 | VHHH | HH | HH | BJ | O | TD |  | BB | BB | BB | BB | HH |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | ISBC01 | VHHH | HH | HH | HH | O | TD | TD |  | BB | BB | BB |  |
|  | ISBC01 | RJTD | O | TD | TD | TD | TD | TD |  | BB | BB | BB |  |
|  | SDKO20 | RKSL |  |  |  |  |  | O |  |  |  |  |  |
|  | SDMS20 | WMKK | BB | TD | KK | TD |  |  | BB | O | BB | BB |  |
|  | SDPH20 | RPMM | MM | TD | TD |  |  | TD | BB |  | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | SDTH20 | VTBB | BB | TD | O | TD |  |  | BB | BB | BB | BB |  |
|  | SDVS20 | VNNN | BB | TD | NN | TD | TD |  | O | BB | BB | BB |  |

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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Receiving station | | | | | | | | | | |
| Type of Data | Heading | | TD | BJ | BB | HH | MM | SL | NN | KK | IV | PP | MC |
|  |  |  | \* |  |  |  |  |  |  |  |  |  |  |
| Satellite | TPPN10 | PGTW |  |  | TD | TD |  |  | BB | BB | BB | BB |  |
| guidance | TPPN10 | PGUA | \* |  | TD | TD |  |  | BB | BB | BB | BB |  |
|  | TPPA1 | RJTY | \* | TD | TD | TD | TD |  | BB | BB | BB | BB |  |
|  | TPPA1 | RODN | \* | TD | TD | TD | TD |  | BB | BB | BB | BB |  |
|  | IUCC10 | RJTD | O | TD | TD | TD | TD | TD |  | BB | BB | BB |  |
|  | IUCC01 | VHHH | HH | HH | HH | O |  |  |  |  |  |  |  |
|  | IUCC02 | VHHH | HH | HH | HH | O |  |  |  |  |  |  |  |
|  | IUCC03 | VHHH | HH | HH | HH | O |  |  |  |  |  |  |  |
|  | IUCC04 | VHHH | HH | HH | HH | O |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Tropical | FXPQ01 | VHHH | HH | HH | BJ | O |  |  | BB | BB | BB | BB | HH |
| Cyclone | FXPQ02 | VHHH | HH | HH | BJ | O |  |  | BB | BB | BB | BB | HH |
| Forecast | FXPQ03 | VHHH | HH | HH | BJ | O |  |  | BB | BB | BB | BB | HH |
|  | FXPQ20 | VHHH | HH | HH | BJ | O | TD | TD | BB | BB | BB | BB | HH |
|  | FXPQ21 | VHHH | HH | HH |  | O |  |  |  |  |  |  |  |
|  | FXPQ20 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | FXPQ21 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | FXPQ22 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | FXPQ23 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | FXPQ24 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | FXPQ25 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | FXPQ29 | VTBB |  |  | O |  |  |  |  |  |  |  |  |
|  | FXPH20 | RPMM | MM | TD | TD | TD | O | TD | BB | BB | BB | BB |  |
|  | FXSS01 | VHHH | HH | HH | BJ | O |  |  | BB | BB | BB | BB | HH |
|  | FXSS02 | VHHH | HH | HH | BJ | O |  |  | BB | BB | BB | BB | HH |
|  | FXSS03 | VHHH | HH | HH | BJ | O |  |  | BB | BB | BB | BB | HH |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | FXSS20 | VHHH | HH | HH | BJ | O | TD | TD | BB | BB | BB | BB | HH |
|  | FXSS21 | VHHH | HH | HH |  | O |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Warning | WDPN31 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WDPN32 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WHCI28 | BCGZ |  |  | BJ | BJ |  |  | BJ | BB | BB | BB |  |
|  | WHCI40 | BABJ | BJ | O | BJ | BJ |  |  | BJ | BB | BB | BB |  |
|  | WSPH | RPMM | \* | TD | TD | TD | O | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | WTMU40 | VMMC | BJ | MC | BJ | BJ |  |  | BB | BB | BB | BB | O |
|  | WTPN21 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPN31 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPN32 | PGTW | \* | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPH20 | RPMM | MM | TD | TD | TD | O |  | BB |  | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | WTPH21 | RPMM |  |  | TD |  | O |  | BB |  | BB | BB |  |
|  | WTPQ20 | VHHH | HH | HH | BJ | O |  | TD | BB | BB | BB | BB | HH |
|  | WTSS20 | VHHH | HH | HH | BJ | O |  |  | BB | BB | BB | BB | HH |
|  | WTTH20 | VTBB | BB | TD | O | TD |  |  | BB | BB | BB | BB |  |
|  | WTVS20 | VNNN |  |  | NN | BJ |  |  | O | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Continued to* | WTPQ20 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
| *the next page* | WTPQ21 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |

APPENDIX 5-E, p.4

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Receiving station | | | | | | | | | | |
| Type of Data | Heading | | TD | BJ | BB | HH | MM | SL | NN | KK | IV | PP | MC |
|  | WTPQ22 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPQ23 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPQ24 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPQ25 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTKO20 | RKSL | SL | TD | TD | TD |  | O | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Prognostic | WTPQ30 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
| Reasoning | WTPQ31 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPQ32 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPQ33 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPQ34 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | WTPQ35 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Five-day | WTPQ50 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
| track | WTPQ51 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
| forecast | WTPQ52 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPQ53 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  | WTPQ54 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | WTPQ55 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |
| Others |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Best track | AXPQ20 | RJTD | O | TD | TD | TD | TD | TD | BB | BB | BB | BB |  |

APPENDIX 5-E, p.5

Note: Meaning of abbreviation

O : Data originating centre

TD : Data transmitting centre - Tokyo

BJ : - Beijing

BB : - Bangkok

HH : - Hong Kong

MM : - Manila

SL : - Seoul

NN : - Hanoi

KK : - Kuala Lumpur

IV : - Vientiane

PP : - Phnom Penh

MC : - Macao

\* : Places other than described above

### APPENDIX 5-F

**TABLE of Abbreviated headings (TTAAii CCCC)**

|  |  |
| --- | --- |
| TT | Data designator |
| FX | Miscellaneous forecasts |
| SB | Radar reports PART A |
| SC | Radar reports PART B |
| SD | Radar reports |
|  | (PART A and PART B) |
| SN | Synoptic reports |
|  | (non-standard hours) |
| TP | Satellite guidance |
| UA | Aircraft reports (AIREP) |
| UE | Upper-level observation, PART D |
| UK | Upper-level observation, PART B |
| UL | Upper-level observation, PART C |
| US | Upper-level observation, PART A |
| WD | Prognostic reasoning for typhoon |
| WH | Marine/Coastal flood warnings |
| WO | Other warnings |
| WC | Tropical cyclone(SIGMET) |
| WT | Tropical cyclone warnings |
| WW | Warning and weather summary |

|  |  |
| --- | --- |
| TABLE of Abbreviated Headings | |
| (TTAAii CCCC) for BUFR | |
|  |  |
| TTAAii CCCC | Data type |
| ISBC01 RJTD | Radar reports |
| ISBC01 VHHH | Radar reports |
| IUCC01-04 VHHH | SAREP reports |
| IUCC10 RJTD | SAREP reports |

|  |  |
| --- | --- |
| AA | Geographic designator |
| CI | China |
| HK | Hong Kong, China |
| JP | Japan |
| KO | Republic of Korea |
| KP | Cambodia |
| LA | Lao People’s Democratic Republic |
| MS | Malaysia |
| MU | Macao, China |
| PA | Pacific area |
| PH | Philippines |
| PN | North Pacific area |
| PQ | Western North Pacific |
| PW | Western Pacific area |
| SS | South China Sea area |
| TH | Thailand |
| VS | Viet Nam |

|  |  |
| --- | --- |
| CCCC | Location indicator |
| BABJ | Beijing |
| BCGZ | Guangzhou |
| KWBC | Washington |
| PGFA | Guam (F.W.C) |
| PGTW | Guam (JTWC) |
| PGUM | Guam (Agana) |
| RJTD | Tokyo |
| RJTY | Yokota |
| RKSL | Seoul |
| RKSO | Osan |
| RODN | Okinawa / Kadena AB |
| RPMK | Clark AB |
| RPMM | Manila / Intl. |
| VDPP | Phnom Penh |
| VHHH | Hong Kong |
| VLIV | Vientiane |
| VMMC | Macao |
| VNNN | Hanoi |
| VTBB | Bangkok |
| WMKK | Kuala Lumpur |

### APPENDIX 6-A

**EXAMPLE OF THE MESSAGE FORMAT FOR INQUIRY**

**ON DOUBTFUL AND GARBLED REPORTS**

**Example 1. Inquiry on a doubtful report**

BMBB01 VTBB 220245

RJTD

PLEASE CHECK THE FOLLOWING REPORT

BULLETIN SNTH20 VTBB

DATE AND TIME 210200

LOCATION 48300

CONTENT SECTION 1, 2ND GROUP: 80540

REGARDS

RSMC TOKYO =

**Example 2. Inquiry on a garbled report**

BMRR01 RPMM 210425

RJTD

AHD SNPH20 RPMM 210400 =

### APPENDIX 6-B, p.1

**PROCEDURES OF REGULAR MONITORING**

**AT RSMC TOKYO - TYPHOON CENTER**

**1. Monitoring period**

The two appropriate periods are selected from the one year starting on 1st January and ending on 31st December. Each period will be up to five consecutive days.

**2. Items of monitoring**

The reception time of reports at RSMC Tokyo should be monitored. The types of reports to be monitored are:

(i) hourly surface observations (SYNOP code),

(ii) hourly ship and buoy observations (SHIP and BUOY codes),

(iii) 6-hourly upper-air observations (TEMP and PILOT codes),

(iv) hourly radar observations (BUFR and/or RADOB codes).

**3. Format of monitoring results**

Samples of format of monitoring results are shown in Fig. 6-B.1 to Fig 6-B.4.

**4. Distribution of monitoring results**

The monitoring results should be distributed once a year by RSMC Tokyo - Typhoon Center to Typhoon Committee Secretariat and its Members by the end of every year. A copy will be forwarded to WMO Secretariat. Members can also retrieve the data from the Internet server of JMA (http://www.wis-jma.go.jp/monitoring/data/monitoring/) by using HTTP.

APPENDIX 6-B, p.2

RECEPTION TIME OF SYNOP REPORTS



Fig. 6-B.1 Format of monitoring results for SYNOP

RECEPTION TIME OF SHIP/BUOY REPORTS



Fig. 6-B.2 Format of monitoring results for SHIP and BUOY

APPENDIX 6-B, p.3

RECEPTION TIME OF UPPER-AIR REPORTS



Fig. 6-B.3 Format of monitoring results for TEMP and PILOT

RECEPTION TIME OF RADAR REPORTS



Fig. 6-B.4 Format of monitoring results for Radar reports

### APPENDIX 6-C

**EXAMPLE OF BEST TRACK REPORT**

AXPQ20 RJTD 060400

RSMC TROPICAL CYCLONE BEST TRACK

NAME 9009 TASHA (9009)

PERIOD FROM JUL2612UTC TO AUG0100UTC

2612 20.0N 119.6E 1002HPA //KT 2618 19.6N 120.0E 1000HPA //KT

2700 19.2N 120.2E 1000HPA //KT 2706 18.8N 120.2E 1000HPA //KT

2712 18.6N 119.8E 1000HPA //KT 2718 18.6N 119.2E 1000HPA //KT

2800 18.6N 118.3E 996HPA 35KT 2806 18.6N 118.0E 992HPA 40KT

2812 18.7N 117.6E 990HPA 45KT 2818 18.8N 117.4E 990HPA 45KT

2900 18.9N 117.2E 990HPA 45KT 2906 18.8N 116.5E 985HPA 50KT

2912 18.8N 116.0E 985HPA 50KT 2918 19.0N 116.0E 985HPA 50KT

3000 19.4N 115.5E 980HPA 55KT 3006 20.1N 115.8E 980HPA 55KT

3012 21.4N 115.8E 980HPA 55KT 3018 22.0N 116.0E 980HPA 55KT

3100 23.6N 115.1E 985HPA 50KT 3106 25.0N 114.7E 990HPA 45KT

3112 25.5N 114.4E 996HPA 35KT 3118 25.8N 114.3E 998HPA //KT

0100 26.2N 114.6E 1000HPA //KT

REMARKS

TD FROMATION AT JUL2612UTC

FROM TD TO TS AT JUL2800UTC

FROM TS TO STS AT JUL2906UTC

FROM STS TO TS AT JUL3106UTC

FROM TS TO TD AT JUL3118UTC

DISSIPATION AT AUG0106UTC=

### APPENDIX 6-D

**STANDARD PROCEDURES FOR THE VERIFICATION**

**OF TYPHOON ANALYSIS AND FORECAST**

**AT NATIONAL METEOROLOGICAL CENTRES**

**1. General**

Each Member will verify each typhoon which affects it and summarize the verification made in a year

**2. Basis for verification**

The best initial typhoon position, central pressure and maximum sustained wind as determined from a post-analysis conducted by the RSMC.

**3. Points for verification**

(1) Error statistics in each method (bias and standard deviation) by using common work   
 sheets as shown in Appendix [6-E](#_APPENDIX_6-E,_p.1). Statistical computations involve positioning of the   
 centre, prediction of movement, and analysis and forecast of intensity of a tropical   
 cyclone.

(2) Discussion of following points;

(i) relative merits of each technique,

(ii) effects of inaccuracies on the forecast,

(iii) effects of meagreness of available relevant real-time observations,

(iv) variation from one geographical area to another,

(v) climatological factors in climatological and/or statistical method,

(vi) large-scale circulation pattern for giving rise to extremely poor prediction   
 performance.

### APPENDIX 6-E, p.1

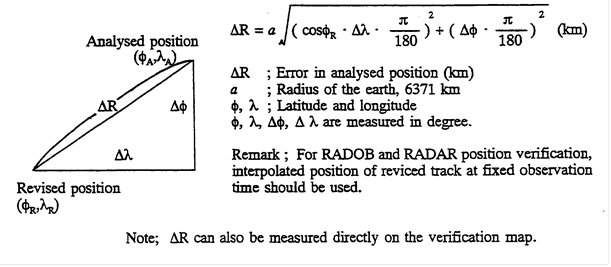
**Verification sheet for positioning of the centre, prediction of movement,**

**and analysis and forecast of intensity of tropical cyclones**

Typhoon ( )

Method

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Date | Analysed position | | Revised position | | Error | | |
| φA | λA | φR | λR | Δφ | Δλ | ΔR |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
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APPENDIX 6-E, p.2

**Verification sheet for positioning of the centre, prediction of movement,**

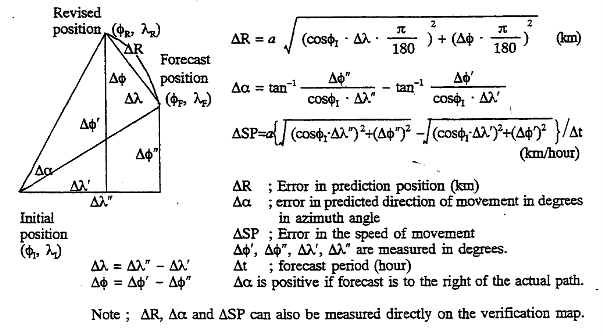
**and analysis and forecast of intensity of tropical cyclones**

Typhoon ( )

Method Forecast period 24-hour (check one)

48-hour

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Initial  Date | Initial  position | | Forecast  position | | Revised  position | | Error | | | | |
| φI | λI | φF | λF | φR | λR | Δφ | Δλ | ΔR | Δα | ΔSP |
|  |  |  |  |  |  |  |  |  |  |  |  |
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APPENDIX 6-E, p.3

**Verification sheet for positioning of the centre, prediction of movement,**

**and analysis and forecast of intensity of tropical cyclones**

Typhoon ( )

Analysis 24-hour forecast 48-hour forecast

Method

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Date |  | Pa | Pr | ΔPa |  | Pf | Pr | ΔPf |  | Pf | Pr | ΔPf |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
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Note :

Pr : Revised central pressure

Pa : Analysed central pressure, ΔPa = Pa - Pr

Pf : Predicted central pressure, ΔPf = Pf - Pr

### APPENDIX 7-A, p.1

**LIST OF DATA ARCHIVED BY RSMC TOKYO - TYPHOON CENTER**

1. **Observation data (except for Himawari imagery data)**

**Kinds of data:** SYNOP, AMeDAS, SHIP, BUOY, TEMP, PILOT, Aircraft,

Wind Profiler, AMV, Scatterometer, MW Sounder, MW Imager,

CSR, GNSS-RO, GNSS-PWV, Radar Reflectivity, Radial Velocity,

R/A, Typhoon Bogus

**(b) Himawari imagery data**

**Himawari Standard Data (HSD):**

**Kind of data:** Himawari full-spec imagery data

**Data format:** Himawari Standard Format (http://www.data.jma.go.jp/mscweb/en/himawari89/space\_segment/hsd\_sample/HS\_D\_users\_guide\_en\_v13.pdf)

**Meteorological Satellite Center Monthly Report (DVD):**

**Kinds of data:** Himawari images in SATAID and PNG formats.

(http://www.data.jma.go.jp/mscweb/en/product/library/report/)

**Area coverage:**

SATAID: 115°E ~ 150°E and 15°N ~ 50°N

PNG: Full earth disk as seen from 140°E

**(c) Objective Analysis data**

**Global Surface/Atmospheric Analysis data**

**Kinds of data:** Grid point data of the objective surface/atmospheric analysis

**Area coverage:** Global area covered by 1.25 X 1.25 latitude-longitude grid system.

**Time of analysis:** 00, 06, 12 and 18 UTC

**Element and layer:**

Surface: Sea surface pressure (Ps), temperature (Ts),

Dew point depression (Ts - Tds), wind (Us, Vs);

Specific pressure levels (1000 - 0.4 hPa):

Geopotential height (Z), temperature (T), wind (U, V),

Dew point depression (T-Td)

APPENDIX 7-A, p.2

**Western North Pacific Sea Surface Temperature Analysis data**

**Kinds of data:** Grid point data of the objective sea surface temperature analysis

**Area coverage:** Western North Pacific area (100°E ~ 180°E and 0° ~ 60°N)

covered by 0.1 X 0.1 latitude- longitude grid system.

**Time of analysis:** 18 UTC

**Element:** SST, SST anomalies from the JMA climatology

### APPENDIX 7-B, p.1

**GLOBAL TROPICAL CYCLONE TRACK AND INTENSITY DATA SET**

**- REPORT FORMAT**

|  |  |
| --- | --- |
| Position | Content |
| 1-9 | Cyclone Identification code composed by 2 digit numbers in order within the cyclone season, area code and year code. 01SWI2000 shows the 1st system observer in South-West Indian Ocean basin during the 2000/2001 season.  Area codes are as follows:  ARB = Arabian Sea  ATL = Atlantic Ocean  AUB = Australian Region (Brisbane)  AUD = Australian Region (Darwin)  AUP = Australian Region (Perth)  BOB = Bay of Bengal  CNP = Central North Pacific Ocean  ENP = Eastern North Pacific Ocean  ZEA = New Zealand Region  SWI = South-West Indian Ocean  SWP = South-West Pacific Ocean  WNP = Western North Pacific Ocean and South China Sea |
| 10-19 | Storm Name |
| 20-23 | Year |
| 24-25 | Month (01-12) |
| 26-27 | Day (01-31) |
| 28-29 | Hour-universal time (at least every 6 hourly position -00Z, 06Z, 12Z and 18Z)  Latitude indicator:  1=North latitude;  2=South latitude |
| 31-33 | Latitude (degrees and tenths) |
| 34-35 | Check sum (sum of all digits in the latitude) |
| 36 | Longitude indicator:  1=West longitude;  2=East longitude |
| 37-40 | Longitude (degrees and tenths) |
| 41-42 | Check sum (sum of all digits in the longitude) |
| 43 | Position confidence\*  1 = good (<30nm; <55km)  2 = fair (30-60nm; 55-110km)  3 = poor (>60nml >110km)  9 = unknown |
| Note\* | Confidence in the center position: Degree of confidence in the center position of a tropical cyclone expressed as the radius of the smallest circle within which the center may be located by the analysis. “position good” implies a radius of less than 30nm, 55km; “position fair”, a radius of 30 to 60nm, 55 to 110km; and “position poor”, radius of greater than 60nm, 110km. |
| 44-45 | Dovorak T-number (99 for no report) |
| 46-47 | Dovorak CI-number (99 for no report) |
| 48-50 | Maximum average wind speed (whole values) (999 for no report) |
| 51 | Units 1=kt, 2=m/s, 3=km per hour. |
| 52-53 | Time interval for averaging wind speed (minutes for measured or derived wind speed, 99 if unknown or estimated). |
| 54-56 | Maximum Wind Gust (999 for noreport) |
| 57 | Gust Period (sedonds, 9 for unknown) |
| 58 | Quality code for wind reports:  1=Aircraft or Dropsonde observation  2=Over water observation (e.g. buoy)  3=Over land observation  4=Dvorak estimate  5=Other |

APPENDIX 7-B, p.2

|  |  |
| --- | --- |
| 59-62 | Central pressure (nearest hectopascal) (9999 if unknown or unavailable) |
| 63 | Quality code for pressure report (same code as for winds) |
| 64 | Units of length: 1=nm, 2=km |
| 65-67 | Radius of maximum winds (999 for no report) |
| 68 | Quality code for RMW:  1=Aircraft observation  2=Radar with well-defined eye  3=Satellite with well-defined eye  4=Radar or satellite, poorly-defined eye  5=Other estimate |
| 69-71 | Threshold value for wind speed (gale force preferred, 999 for no report) |
| 72-75 | Radius in Sector 1: 315°-45° |
| 75-79 | Radius in Sector 2: 45°-135° |
| 80-83 | Radius in Sector 3: 135°-225° |
| 84-87 | Radius in Sector 4: 225°-315° |
| 88 | Quality code for wind threshold  1=Aircraft observations  2=Surface observations  3=Estimate from outer closed isobar  4=Other estimate |
| 89-91 | Second threshold value for wind speed (999 for no report) |
| 92-95 | Radius in Sector 1: 315°-45° |
| 95-99 | Radius in Sector 2: 45°-135° |
| 100-103 | Radius in Sector 3: 135°-225° |
| 104-107 | Radius in Sector 4: 225°-315° |
| 108 | Quality code for wind threshold (code as for row 88) |
| 109-110 | Cyclone type:  01= tropics; disturbance (no closed isobars)  02= <34 knot winds, <17m/s winds and at least one closed isobar  03= 34-63 knots, 17-32m/s  04= >63 knots, >32m/s  05= extratropical  06= dissipating  07= subtropical cyclone (nonfrontal, low pressure system that comprises initially baroclinic circulation developing over subtropical water)  08= overland  09= unknown |
| 111-112 | Source code (2 – digit code to represent the country or organization that provided the data to NCDC USA. WMO Secretarist is authorized to assign number to additional participating centers, organizations)  01 RSMC Miami-Hurricane Center  02 RSMC Tokyo-Typhoon Center  03 RSMC-tropical cyclones New Delhi  04 RSMC La Reunion-Tropical Cyclone Centre  05 Australian Bureau of Meteorology  06 Meteorological Service of New Zealand Ltd. |
|  | 07 RSMC Nadi-Tropical Cyclone Centre  08\*\* Joint Typhoon Warning Center, Honolulu  09\*\* Madagascar Meteorological Service  10\*\* Mauritius Meteorological Service  11\*\* Meteorological Service, New Caledonia  12 Central Pacific Hurricane Center, Honolulu |
| Note\*\* | no longer used |
| Headings | 1-19 Cyclone identification code and name; 20-29 Date time group;  30-43 Best track positions;  44-110 Intensity, Size and Type;  111-112 Source code. |

1. \* Details are shown in [4.2](#4.2 Classification of tropical cyclones*, **). [↑](#footnote-ref-1)
2. For converting the wind speeds of different averaging periods such as 1-min, 2-min, 3-min and 10-min, Tropical Cyclone Programme of WMO recommends to follow the guidelines as shown in the Appendix [1-A](#APPENDIX 1-A, p.1). [↑](#footnote-ref-2)
3. \* ICAO ROBEX scheme is the method to exchange operational aeronautical meteorological (OPMET) information. The scheme consists of ROBEX collecting and disseminating centres (ROBEX centres), regional OPMET data banks (RODB), and interregional OPMET gateways (IROG). [↑](#footnote-ref-3)
4. \* "Tropical cyclone" is a generic term that includes tropical depression, tropical storm, severe tropical storm and typhoon.

   \*\* Classifications internally used by Members are shown in Appendix [4-A](#APPENDIX 4-A). [↑](#footnote-ref-4)
5. As detailed in Harper et al. (2010), this traditional assumption is without a firm basis. [↑](#footnote-ref-5)