

ANNEX A: Availability of Minimum Required NWP Products from Global Centres

Deterministic Forecasts:	Availability
6-hourly out to 72 hours, then 12-hourly up to 144 hours	JMA
Parameters: wind (streamlines and speed/direction), temperature, geopotential height, humidity Levels: sfc, 925hPa, 850hPa, 700hPa, 500hPa, 300hPa, 200hPa Purpose: General forecasting parameters to gain a perspective on the overall atmosphere. For determination of frontal system and pressure maxima locations.	YES
Parameter: vorticity Level: 500hPa, 300hPa Purpose: Determination of frontal and low pressure system locations. Crucial in locating potential severe weather outbreak locations. Can be used in determination of severe weather type	YES
Parameter: vertical velocity Level: 850hPa, 700hPa, 300hPa Purpose: Determination of mesoscale patterns of rising and sinking air masses (convective updrafts)	YES
Parameter: 850hPa wet bulb potential temperature Level: 850hPa Purpose: Frontal position diagnosis and change in airmass	NO
Parameters: instantaneous and accumulated precipitation, minimum temperature, maximum temperature, sea level pressure, relative humidity Level: sfc Purpose: General forecasting parameters	YES except instantaneous precipitation
Parameter: 1000-500hPa thickness Level: partial atmospheric column Purpose: Freezing level determination and air mass distinguishing	YES
Parameter: precipitable water Level: atmospheric column Purpose: Determination of total liquid water in the atmosphere and thus potential rainfall	YES
Parameter: convective available potential energy (CAPE), Theta-E Level: atmospheric column Purpose: Amount of energy available in the atmosphere for storm production	YES
Parameter: lifted index, K index, total totals index Level: stability index Purpose: Pre-calculated indices to generalize severe weather potential	K index is only available
Parameter: convective inhibition (CIN) Level: stability index Purpose: Strength of force preventing convective initiation. The amount of energy (frontal forcing or daytime heating) that is needed to begin convection.	YES
Ensemble Forecasts:	Availability
12-hourly out to 144 hours	JMA
Probability of 6-hour accumulated precipitation exceeding 50mm and 100mm threshold value	YES
Probability of 24-hour accumulated precipitation exceeding 100mm threshold value	YES
Probability of 10-meter wind speed exceeding 20kt and 30kt threshold value	YES
Probability of significant wave height exceeding 2 m, 4 m and 6 m threshold value	YES
Probability of mean wave period exceeding 10 s and 15 s threshold value	YES
Ensemble Prediction System meteograms for specified locations (10-day / 15-day)	YES (10-day)
Spaghetti diagrams for 500hPa geopotential height	YES
Thumbnails of probability of precipitation in excess of threshold of 50mm/6h at 6 hours intervals	YES
Extreme Forecast Index and Shift of Tails, and M-Climate for TMean, Tmax, Tmin, wind gust, wind speed, total precipitation, Max significant wave height, total snowfall	NO
ENS Cumulative Distribution Functions (Forecast and M-Climate) and EFI values (for precipitation, temperature and wind gust)	NO
MJO Index - Extended range forecast	NO
Tropical cyclone occurrence and genesis probability maps – including extended range forecast	NO
Tropical cyclone strike probability maps	NO
Tropical cyclone forecast tracks from ensemble members, including ensemble mean, deterministic and control tracks	NO

Tropical Cyclone Lagrangian meteograms	NO
Other REQUESTED Products:	
	Availability
	JMA
SKEW-T logarithmic forecast plots for selected grid points based on NWP output (out to 144 hours, 12-hourly)	NO

Remark: ECMWF will provide the indicated products as soon as possible; however, some products (e.g. Shift-of-tails, M-climate, CDF, extended-range) may not be available initially

ANNEX B: List of the Stations of EPSgrams provided by Global Centres

Remark: ECMWF provides EPSgrams (known at ECMWF as "ENS meteograms") at stations in the form of italic style.

B.1 Cambodia

B.1.1 List of stations for EPSgrams

WMO ID	Station Name	Latitude North	Longitude East	Altitude [m]	JMA
48969	<i>Bantey Meanchey</i>	13°37'	102°58'	31	○
48962	Battambang	13°06'	103°12'	13	○
48990	<i>Kandal</i>	11°26'	104°49'	8	○
48986	<i>Koh Kong</i>	11°38'	102 59'	13	○
48995	<i>Kompomg Cham</i>	12°	105°27'	14	○
48967	Kompong Chhnang	12°13'	104°40'	15	○
48992	<i>Kompong Speu</i>	11°28'	104°34'	27	○
48965	<i>Kompong Thom</i>	12°41'	104°54'	13	○
48985	<i>Kompot</i>	10°36'	104°11'	4	○
48970	Krotie	12°29'	106°10'	23	○
48991	<i>Pochentong</i>	11°33'	104°50'	11	○
48964	<i>Preh Vihear</i>	14°06'	105° 09'	62	○
48997	<i>Prey Veng</i>	11°29'	105°19'	13	○
48968	Pursat	12°33'	103°51'	18	○
48973	Rattanakiri	13°44'	106°59'	330	○
48966	Siemreap	13°22'	103°51'	15	○
48983	<i>Sihanouk Ville</i>	10°37'	103°29'	13	○
48972	Stung Treng	13°31'	105°58'	54	○
48998	Svay Reing	11°50'	105°48'	6	○
48993	Takeo	10°59'	104°48'	6	○
48971	Mondul Kiri	12°27'	107°11'	690	○
48963	Pailin	12°48'	102°36'	170	○

B.2 Lao PDR

B.2.1 List of stations for EPSgrams

WMO ID	Station Name	Latitude North	Longitude East	Altitude [m]	JMA
48921	Phongxali	21.6763	102.0921	1300	○
48924	<i>Louangnamtha</i>	20.9310	101.4165	600	○
48925	Oudomxai	20.6967	101.9915	636	○
48926	Houayxay	20.2619	100.4372	401	○
48930	<i>Louangphbang</i>	19.8984	102.1652	305	○
48938	Xaignabouli	19.2438	101.7103	326	○
48927	Viangxai	20.4174	104.2309	913	○
48935	Phonsavan	19.4438	103.1711	1094	○
48941	Phonhong	18.4930	102.4488	179	○
48940	<i>Vientiane</i>	17.9700	102.5704	171	○
48945	<i>Pakxan</i>	18.3911	103.6657	157	○

48946	<i>Thakhek</i>	17.4048	104.8084	151	○
48947	<i>Savannakhet</i>	16.5523	104.7545	144	○
48952	Salavan	15.7119	106.4127	168	○
48953	<i>Xekong</i>	15.3424	106.7199	143	○
48955	<i>Pakxe</i>	15.1201	105.8561	104	○
48957	Attapu	14.8111	106.8302	105	○

B.3 Philippines

B.3.1 List of stations for EPSgrams

WMO ID	Station Name	Latitude North	Longitude East	Altitude [m]	JMA
98434	INFANTA	14.7464	121.6489	7	○
98223	LAOAG	18.1828	120.5342	5	○
98233	TUGUEGARAO	17.6375	121.7525	62	○
98325	DAGUPAN	16.0867	120.3522	2	○
98327	CLARK AB	15.1853	120.5489	155	○
98328	BAGUIO	16.4039	120.6014	1510.08	○
98334	BALER RADAR	15.7492	121.6319	2256	○
98425	MANILA	14.5869	120.9786	13	○
98531	SAN JOSE	12.3608	121.0475	3.314	○
98430	SCIENCE GARDEN	14.6447	121.0444	43	○
98431	CALAPAN	13.4097	121.1894	41	○
98432	AMBULONG	14.0900	121.0550	11	○
98444	LEGASPI	13.1506	123.7283	17	○
98440	DAET	14.1286	122.9825	4	○
98546	CATARMAN	12.5053	124.6283	7	○
98550	TACLOBAN	11.2256	125.0247	3	○
98618	PUERTO PRINCESA	9.7403	118.7586	15	○
98637	ILOILO	10.7131	122.5431	6	○
98642	DUMAGUETE	9.3331	123.2992	7	○
98644	TAGBILARAN	9.6669	123.8558	8	○
98558	GUIUAN	11.0453	125.7556	60	○
98646	MACTAN	10.3222	123.9800	24	○
98748	CAGAYAN DE ORO	8.4839	124.6475	6	○
98751	MALAYBALAY	8.1511	125.1339	609	○
98753	DAVAO AIRPORT	7.1278	125.6547	18	○
98755	HINATUAN	8.3664	126.3378	3	○
98836	ZAMBOANGA	6.9194	122.0631	6	○

B.4 Thailand

B.4.1 List of stations for EPSgrams

WMO ID	Station Name	Latitude North	Longitude East	Altitude [m]	JMA
48327	<i>Chiang Mai</i>	18.8	99	314	○
48378	<i>Phitsanulok</i>	16.8	100.3	46	○
48354	<i>Udon Thani</i>	17.4	102.8	178	○

48407	<i>Ubon Ratchathani</i>	15.2	104.9	124	○
48400	<i>Nakhon Sawan</i>	15.8	100.2	35	○
48455	<i>Bangkok</i>	13.7	100.6	4	○
48462	<i>Aranyaprathet</i>	13.7	102.6	49	○
48500	<i>Prachuap Khirikhan</i>	11.8	99.8	5	○
48568	<i>Songkhla</i>	7.2	100.6	7	○
48565	<i>Phuket Airport</i>	8.2	98.3	9	○
48331	Nan	18.78	100.78	200	○
48421	Thong Phaphum	14.74	98.64	97.36	○
48357	Nakhon Phanom	17.42	104.78	145	○
48431	Nakhon Ratchasima	14.96	102.07	186	○
48501	Trad	11.77	102.88	2	○
48551	Surat Thani	9.14	99.15	5	○

B.5 Viet Nam

B.5.1 List of stations for EPSgrams

WMO ID	Station Name	Latitude North	Longitude East	Altitude [m]	JMA
48808	Cao Bang	22.67	106.25	243	○
48803	Lao Cai	22.5	103.97	97	○
48830	Lang Son	21.83	106.77	263	○
48806	<i>Son La</i>	21.33	103.9	676	○
48820	<i>Ha Noi</i>	21	105.88	7	○
48826	<i>Phu Lien</i>	20.8	106.63	116	○
48823	Nam Dinh	20.43	106.15	3	○
48839	Bach Long Vi	20.13	107.72	56	○
48840	<i>Thanh Hoa</i>	19.75	105.78	5	○
48845	<i>Vinh</i>	18.67	105.68	6	○
48848	Đong Hoi	17.48	106.6	8	○
48852	<i>Hue</i>	16.43	107.58	9	○
48855	<i>Đa Nang</i>	16.03	108.2	7	○
48866	<i>Pleiku</i>	13.98	108	779	○
48870	Quy Nhon	13.77	109.22	6	○
48877	Nha Trang	12.22	109.22	4	○
48892	Song Tu Tay	11.42	114.33	5	○
48887	Phan Thiet	10.93	108.1	5	○
48900	<i>Ho Chi Minh</i>	10.82	106.67	10	○
48917	Phu Quoc	10.22	103.97	4	○
48916	Tho Chu	9.28	103.47	0	○
48914	Ca Mau	9.18	105.15	3	○
48918	Con son	8.68	106.6	9	○
48920	Truong Sa	8.65	111.92	3	○
48919	Huyen Tran	8.02	110.62	19	○

C.2 RSMC Tokyo – Typhoon Centre

Product List of RSMC Tokyo – Typhoon Centre

Products via GTS and AFTN

1. RSMC Tokyo issues bulletins on TC satellite image analysis in satellite report (SAREP) shortly after observation times, as well as, on TC forecasts up to 72 hours ahead and TC track forecasts up to 120 hours ahead about 50 minutes and 90 minutes after observation times via GTS and AFTN. The code forms of the bulletins are written in Annual Report on the Activities of the RSMC Tokyo – Typhoon Center (<http://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eq/annualreport.html>).

Table 1. Products of RSMC Tokyo via GTS and/or AFTN

Products	via	WMO header	Frequency	Contents
SAREP	GTS, NTP website	IUCC10RJTD	8 times/day	Center position and its accuracy, Direction and speed of movement, Mean diameter of the overcast cloud, Apparent 24-hour change in intensity, Dvorak Intensity (CI, Final T, DT, MET, PT number), Cloud pattern type of DT number, Trend of past 24-hour change, Cloud picture type of PT number, Type of the final T-number
RSMC Tropical Cyclone Best Track	GTS, RSMC website	AXPQ20RJTD		Center position, Maximum sustained wind speed, Radii of wind areas over 50 and 30knots
RSMC Tropical Cyclone Advisory	GTS, RSMC website	WTPQ20-25RJTD	8 times/day	Center position, Direction and speed of movement, Maximum sustained wind speed (10-minute average), Maximum gust wind speed (analysis and forecast), Accuracy of determination of the center position, Radii of wind areas over 50 and 30 knots (analysis)
RSMC Tropical Cyclone Advisory for Five-day Track Forecast	GTS, RSMC website	WTPQ50-55RJTD	4 times/day	In addition to 72 hours forecast (same as WTPQ20-25), Center position, Direction and speed of movement for 96 and 120 hour forecasts
RSMC Guidance for Forecast	GTS	FXPQ20-25RJTD	4 times/day	Center position, Central pressure, Maximum sustained wind speed (Central pressure and Maximum sustained wind speed are given as deviations from those at the initial time)

RSMC Prognostic Reasoning	GTS, NTP website	WTPQ30-35RJTD	2 times/day	General comments on the forecasting method, the synoptic situation of the subtropical ridge, the movement and intensity of the TC as well as relevant remarks.
Tropical Cyclone Advisory for SIGMET	AFTN	FKPQ30-35RJTD	4 times/day	Center position, Maximum sustained wind speed (analysis and forecast), Direction and speed of movement, Central pressure (analysis)

Products via JMA radio facsimile broadcast

- Analysis and 24- and 48-hours Prognostic Charts of 850 hPa / 200 hPa Stream Line have been distributed via JMA radio facsimile broadcast (JMH) twice a day at 00 and 12 UTC since 1994.

Products via Numerical Typhoon Prediction (NTP) website

- The Centre has been operating the NTP website since October 2004 as its contribution to the WMO/ESCAP Typhoon Committee. Products available at the website along with the planned product are listed in the below table.

Table 2. Products of RSMC Tokyo via NTP website

Products	Frequency	Contents
NWP Weather Map TC track guidance	Twice/day	Mean sea level pressure and 500 hPa Geopotential height (up to 72 hours at 00 TC, up to 168 hours at 12 UTC) of nine major NWP centers (BoM, MSC, CMA, DWD, KMA, UKMO, NCEP, ECMWF and JMA)
TC track guidance	Twice/day	TC track guidance of nine deterministic NWP models (BoM, MSC, CMA, DWD, KMA, UKMO, NCEP, ECMWF and JMA), ensemble TC track guidance of JMA's TEPS
EDA Analysis	4 times/day	Center position and its accuracy, T number
Sea Surface Temperature	once/day	Sea Surface Temperature in the area of responsibility
Tropical Cyclone Heat Potential	once/day	Tropical Cyclone Heat Potential in the area of responsibility
Vertical Wind Shear	4 times/day	Vertical Wind Shear of initial fields of the JMA's global model
Satellite Microwave Products		Microwave TC snapshot (37GHz(H,V,PCT), 89GHz(H,V,PCT), AMSU-based TC intensity(Central pressure, Maximum sustained wind)
Storm Surge Forecasts	4 times/day	Storm surge distribution maps (up to 72 hours ahead), Time series storm surge forecasts (up to 72 hours ahead),
Stream line	4 times/day	Stream line (850 hPa, 200 hPa) based on initial fields of the JMA's global model

Graphical Tropical Cyclone Advisory for SIGMET (planned)	4 times/day	Center position, Maximum sustained wind speed, Direction and speed of movement, Central pressure, height and area of CB associated with a TC
Ensemble track guidance (Planned)		
Strike probability and/or 50 kt wind speed probability (Planned)		
Ensemble TC genesis guidance (Planned)		

ANNEX E: Data and Products delivered from other Projects / Activities

E.1 Special Products from Meteorological Satellite Center, JMA

E.1.1 Products

The Meteorological Satellite Center (MSC) of JMA has provided geostationary satellite "Himawari" imagery with potential areas of heavy rainfall associated with deep convective clouds over the South-East Asia region. The imagery are available on the MSC Web page (https://www.data.jma.go.jp/mscweb/data/himawari/sat_hrp.php?area=r2s). They are also open on RSMC Nowcasting Web page (<https://www.jma.go.jp/jma/jma-eng/jma-center/nowcasting/>).

E.1.2 Contact Point

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E.2 GIFS-Forecast Demonstration Project (FDP) (THORPEX/TIGGE/GIFS), including North Western Pacific Tropical Cyclone (Track) Ensemble Forecast Research Project (WWRP Research Development Project)

E.2.1 Products via website

The MRI/JMA provides TC track forecast guidance through <http://tparc.mri-jma.go.jp/cyclone/login.php> and plots for severe weather events through http://tparc.mri-jma.go.jp/TIGGE/tigge_SWFDP.html.

Products	Provided through	Frequency	Content
TC track forecast	Website	4 times / day	Deterministic and ensemble TC track forecast by major NWP centres.
Ensemble products for severe weather events	Website	1 time / day	Forecast probability of the occurrence of severe weather events such as heavy rainfall, extremely high/low temperature, and strong wind based on the ECMWF, JMA, NCEP and UKMO EPSs

E.2.2 Contact Point

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E.3 RA-II Project on the Provision of City-Specific NWP products

E.3.1 Products via website

The products are available from the following websites:

Products provided by HKO

<http://nwp.weather.gov.hk/cityfc/cambodia/>
<http://nwp.weather.gov.hk/cityfc/laos/>
<http://nwp.weather.gov.hk/cityfc/vietnam/>
<http://nwp.weather.gov.hk/cityfc/thailand/>

Products provided by JMA:

<http://ra2-nwp.kishou.go.jp/cityfc/Cambodia/>
<http://ra2-nwp.kishou.go.jp/cityfc/Lao/>
<http://ra2-nwp.kishou.go.jp/cityfc/Philippines/>
<http://ra2-nwp.kishou.go.jp/cityfc/Thailand/>
<http://ra2-nwp.kishou.go.jp/cityfc/VietNam/>

Products provided by KMA

<http://www.kma.go.kr/ema/nema03/>

E.3.2 Contact Point

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E.4 JMA Pilot Project on EPS products

E.4.1 Products

The detail of products is shown in the following table. All products are provided on the website: <http://eps.kishou.go.jp/EPSSMRFA>

Daily EPS product		Variable	Area or point
EPS charts	- Ensemble mean	- Mean-Sea-Level Pressure (MSLP)	- Northwestern Pacific
	- Normalized spread	- 500hPa geopotential height	- Asia
	- Spaghetti	- MSLP	- South China Sea
	- Stamp map	- Surface Wind	(100°E -130°E, 5°N - 30°N)
Probabilistic maps		- 850 hPa temperature anomalies with thresholds ± 2 , ± 4 , ± 8 K	- Northwestern Pacific
		- Precipitation with thresholds 24, 48, 72 mm/24hours	- Asia
			- Northern Hemisphere
Point forecast	EPSgram (Box plot diagram)	- Surface, 925, 850, 700, 500, 300hPa temperature ($^{\circ}$ C)	- Major cities in Asia
	Plume diagram	- Precipitation rate (mm/6hr)	
		- MSLP (hPa)	
		Accumulated precipitation (mm)	

E.4.2 Contact Point

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E.5 RAI WIGOS Project to Develop Support for NMHSs in Satellite Data, Products and Training

E.5.1 Products

Products are provided on the website:

http://www.jma.go.jp/jma/jma-eng/satellite/ra2wigosproject/ra2wigosproject-intro_en_jma.html

E.5.2 Contact Point

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E.6 Landfall Typhoon Forecast Demonstration Project (WMO-Project, ESCAP/WMO TC)

E.6.1 Products via website

Products are provided on the website: <http://tlfdp.typhoon.gov.cn/>

E.6.2 Contact Point

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