5. APPLICATION PRODUCTS OF NWP

5.1 Summary

The results of NWP are indispensable elements to weather forecasting both for general public and for special purposes, and therefore JMA disseminates them in real time to the local forecast offices of JMA, private weather companies, and related organizations both in Japan and abroad. Although facsimile charts have been the primary means of distributing NWP output for a long time, dissemination in the form of Grid Point Values (GPV) is now the essential method with the progress of telecommunication infrastructure and sophisticated visualization systems.

In addition to the raw NWP data, value-added products derived from NWP output are also disseminated. One example of such products is information on parameters not explicitly calculated in NWP models, such as probabilistic forecasts and turbulence potentials for aviation. Another is error-reduced estimation of NWP output parameters, with statistics of the relationship between NWP output and the corresponding observation. In 2001, JMA started dissemination of new products, Very-short-range (6 hour) Forecast of Precipitation and the Hourly Analysis in horizontal wind and temperature fields, in which NWP output and the latest observation are merged to get the most reliable estimation.

In the following sections, dissemination of NWP information, NWP-based value-added products, and their utilization in JMA forecast offices are demonstrated.

5.2 Facsimile charts

Facsimile charts from numerical weather prediction are transmitted to local meteorological observatories and weather stations via domestic communication lines, and to national meteorological services via the Global Telecommunication System (GTS). Another set of facsimile charts for users on ship is disseminated by radio transmission JMH. Contents and areas of the charts are listed in Table 5.2.1 and Fig. 5.2.1 respectively.

5.3 GPV products

GPV products of numerical weather prediction are transmitted to the meteorological observatories, the weather stations, the Meteorological Satellite Center, the Meteorological Research Institute of JMA, and the Meteorological Business Support Center. General users in Japan including private weather services and news media can obtain GPV products from the Meteorological Business Support Center. Specific GPV products are transmitted to governmental institutes. GPV products of GSM, medium-range EPS, and ocean wave model are provided to national meteorological services through the GTS.

Also two kinds of data services on Internet are established to facilitate use of GPV. One is a data service based on the WMO Distributed Data Bases (DDBs) project and the other based on the Regional Co-operation Programme of the Typhoon Committee using RSMC Data Serving System (RSMC DSS). GPV products of GSM, Mid-range EPS, and Ocean Wave Model transmitted are listed in Table 5.3.1.

Table 5.2.1 List of facsimile charts transmitted through GTS and radio facsimile JMH.

Symbols for 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.

Model	Area (Fig. 5.2.1)	Contents and Level	Forecast Hours	Initial time	Availability
Global Analysis/ Forecast Models	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)		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	
JCDAS	D' (N.H.)	100hPa (Z, Z anomaly to climatology)	5-day average of analysis	00UTC	GTS
		500hPa (Z, Z anomaly to climatology)			
Ocean Wave	C'' (NW Pacific)	Surface (height, period and direction)	12, 24, 48, 72	00/12UTC	GTS/JMH

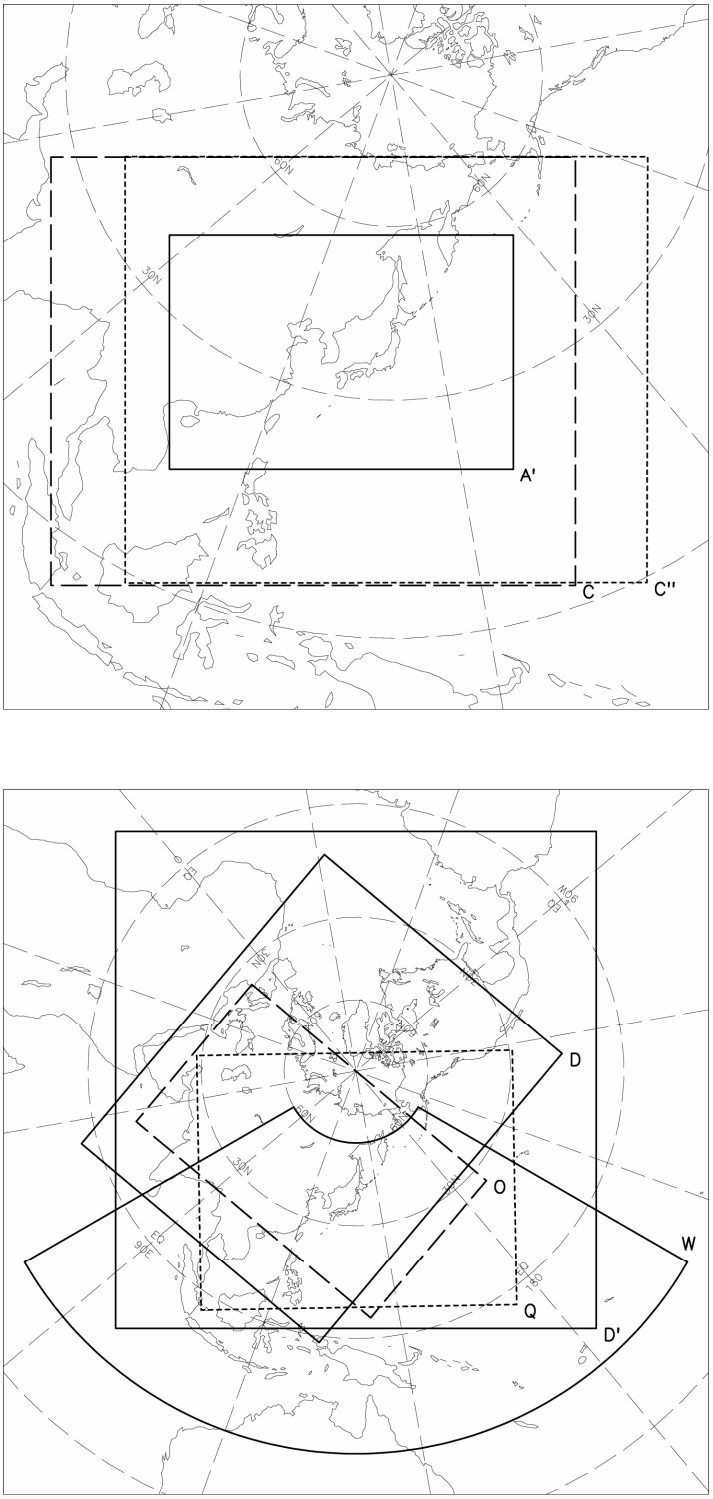

Fig. 5.2.1 Output areas for facsimile charts transmitted through GTS and radio facsimile JMH.

Table 5.3.1 List of GPV products transmitted through GTS, DDB and RSMC DSS.

Symbols for contents: 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, R: rainfall. Prefixes μ and σ stand for average and standard deviation of ensemble prediction results, respectively. Symbols °*¶§‡† indicate limitations on forecast hours or initial time as shown in notes below.

Model	GSM	GSM	GSM
Destination	RSMC	GTS, RSMC, DDB	GTS, RSMC, DDB
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	10hPa: Z, U, V, T 20hPa: Z, U, V, T 30hPa: Z, U, V, T 50hPa: Z, U, V, T 70hPa: Z, U, V, T 100hPa: Z, U, V, T 150hPa: Z, U, V, T 200hPa: Z, U, V, T, ψ, χ 250hPa: Z, U, V, T 300hPa: Z, U, V, T, H, ω 400hPa: Z, U, V, T, H, ω 500hPa: Z, U, V, T, H, ω, ζ 600hPa: Z, U, V, T, H, ω 700hPa: Z, U, V, T, H, ω 850hPa: Z, U, V, T, H, ω, ψ, χ 925hPa: Z, U, V, T, H, ω 1000hPa: Z, U, V, T, H, ω Surface: P, U, V, T, H, R†	10hPa: Z, U, V, T 20hPa: Z, U, V, T 30hPa: Z, U, V, T 50hPa: Z, U, V, T 70hPa: Z, U, V, T 100hPa: Z, U, V, T 150hPa: Z, U, V, T 200hPa: $Z^{§}$, $U^{§}$, $V^{§}$, $T^{§}$, ψ, χ 250hPa: Z, U, V, T 300hPa: Z, U, V, T, D 400hPa: Z, U, V, T, D 500hPa: $Z^{§}$, $U^{§}$, $V^{§}$, $T^{§}$, $D^{§}$, ζ 700hPa: $Z^{§}$, $U^{§}$, $V^{§}$, $T^{§}$, $D^{§}$, ω 850hPa: $Z^{§}$, $U^{§}$, $V^{§}$, $T^{§}$, $D^{§}$, ω, ψ, χ 925hPa: Z, U, V, T, D, ω 1000hPa: Z, U, V, T, D Surface: $P^{¶}$, $U^{¶}$, $V^{¶}$, $T^{¶}$, $D^{¶}$, $R^{¶}$	10hPa: Z*, U*, V*, T* 20hPa: Z*, U*, V*, T* 30hPa: Z°, U°, V°, T° 50hPa: Z°, U°, V°, T° 70hPa: Z°, U°, V°, T° 100hPa: Z°, U°, V°, T° 150hPa: Z*, U*, V*, T* 200hPa: Z, U, V, T 250hPa: Z°, U°, V°, T° 300hPa: Z, U, V, T, D*‡ 400hPa: Z*, U*, V*, T*, D*‡ 500hPa: Z, U, V, T, D*‡ 700hPa: Z, U, V, T, D 850hPa: Z, U, V, T, D 1000hPa: Z, U*, V*, T*, D*‡ Surface: P, U, V, T, D‡, R†
Forecast hours	0–84 every 6 hours and 96–192 every 12 hours † Except analysis	0–84 every 6 hours § additional 96–192 every 24 hours for 12UTC ¶ 0–192 every 6 hours	0–72 every 24 hours and 96–192 every 24 hours for 12UTC ° 0–120 for 12UTC † Except analysis * Analysis only
Initial times	00UTC and 12UTC	00UTC and 12UTC	00UTC and 12UTC ‡ 00UTC only

Model	GSM	Mid-range EPS	Ocean Wave Model
Destination	RSMC	RSMC	RSMC
Area and resolution	20°S–60°N, 80°E–200°E 2.5°×2.5°	Whole globe, 2.5°×2.5°	Global (75°S–75°N, 0°E–358.75°E), 1.25°×1.25°
Levels and elements	100hPa: Z, U, V, T 150hPa: Z, U, V, T 200hPa: Z, U, V, T 250hPa: Z, U, V, T 300hPa: Z, U, V, T 500hPa: Z, U, V, T, D, ζ 700hPa: Z, U, V, T, D, ω 850hPa: Z, U, V, T, D, ω Surface: P, U, V, T, D, R	250hPa: μU, σU, μV, σV 500hPa: μZ, σZ 850hPa: μU, σU, μV, σV, μT, σT 1000hPa: μZ, σZ Surface: μP, σP	Sea Surface: wave height, wave period, prevailing wave direction
Forecast hours	0–36 every 6 hours, 48, 60, and 72	0–192 every 12 hours	0–84 every 6 hours and additional 96–192 every 12 hours for 12UTC
Initial times	00UTC and 12UTC	12UTC	00UTC, 12UTC