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DATA PROCESSING IN REGION II

From the point of Numerical Weather Prediction

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Summary and purpose of document

This document contains the results of the survey and the proposals of the rapporteur to improve the data NWP system in the Region.

ACTION PROPOSED

The group is invited to study this document and consider proposed recommendations to improve GDPFS activities in the Region.

Annexes: Status of GDPFS centers in Region II – Table 1 (Priorities in NWP), Table 2 (Numerical Models), Table 3 (Training and education), Table 4 (Output Products required), Table 5 (Providers of Products), Table 6 (Internet address), Table 7 (Computers), and Table 8 (Contact points)

Appendix: Contents of long-range dynamic prediction at some Web sites in Region II

Status Report for Data Processing and Forecasting Systems in Region II

1. Introduction

A series of surveys were conducted during June 2003 and February 2002, respectively to access the status of data processing and Forecasting Systems (DPFS) in Region II, following the previous one at 2000. The survey was aimed at (1) assessment of the current status of DPFS and update of information on the progress of DPFS in the region, (2) identification of the detailed user requirements on various emerging areas on DPFS, particularly on the use of ensemble products, severe weather information, non-nuclear transport products, and long-range prediction outputs, as discussed in the reports or documents of recent WMO meetings (see reference), (3) monitoring of the exchange of expertise and information through training component and/ or bilateral collaboration, and (4) provision of rationale for the action plan for the advancement of DPFS at region II. Nine Members including the leading NWP centers sent the completed questionnaire to the rapporteur by 8 July 2003. This report is based on the feedbacks from the Members in the region, and other available information from WMO publication or Internet.

2. Current status and user requirements on DPFS in Region II

2.1. Priorities (see Table 1)

2.1.1 Nine Members, mostly from advanced or rapidly developing NWP centers, replied for the top five subjects on NWP for the future.

2.1.2 Data assimilation of asynoptic observation marks the highest priority, accompanied with the nowcasting with radar observation. The ensemble prediction for both global and regional scale ranks as second. It is observed that there is also a growing concern on the development of operational NWP system particularly among the developing NWP centers. The first two subjects are challenging issues even to the advanced NWP centers, while the 3rd subject is relevant to the rapidly developing NWP centers. Semi-Lagrangian numerics and high resolution model with sophisticated physics also appears with high priority. Even though the sample size is rather small, the result partially represents the major interests on NWP from the active NMCs or RSMCs.

2.2. NWP Models (see Table 2)

2.2.1. Global model

China, India, Japan, Republic of Korea, Russian Federation (Regional Specialized Meteorological Center), and Thailand are running a global model. Japan and Russian Federation are also running global models in PCs.

2.2.2. Regional model

China, Hong Kong, China, India, Japan, Republic of Korea, Oman, Thailand, Saudi Arabia, Russian Federation, Vietnam are running a regional models. Saudi Arabia and Vietnam entered this group after 2000 survey. Saudi Arabia and Vietnam use W/S or PCs for running their regional models. Kuwait, Macao, China, Mongolia, Sri Lanka, Uzbekistan, and Republic of Yemen plan to run regional models with personal computer or workstation (from 2000 survey)

2.2.3 High-resolution model (less than 20km in horizontal resolution)

Japan, Hong Kong, China, Republic of Korea, Russian Federation, and Thailand are running a high-resolution model. China, Hong Kong, China, Japan and Republic of Korea upgraded the resolution of NWP models after 2000 survey. Oman has a plan to run a high-resolution model (from 2000 survey)

2.2.4 Data assimilation

The data assimilation is the process for the preparation of initial condition from the synoptic observation as well as remote sensing measurement including satellite and radar. The quality of model products is strongly dependent on the advanced technology. Japan used 3-d or 4-d variational data assimilation scheme for their global and regional models. China, Hong Kong, China, and Republic of Korea do experiments or plan to develop similar schemes.

2.2.5 Ensemble prediction system (EPS)
Four countries (China, Japan, Republic of Korea and Russian Federation) are running EPS in operational basis. The number of ensemble members has been gradually increasing after the 2000 survey. Japan Meteorological Agency recently has been disseminating EPS products via Internet in the region. A few NMCs reported to use the ensemble mean and spaghetti plots.

2.2.6 Long-range prediction
Currently, China, Japan, Republic of Korea, and Russian Federation are running long-range prediction models in operational basis. Hong Kong, China conducted experiments on climate simulation with a regional model (15km, 18 layers) for 84 days. Japan uses operationally a fully coupled climate model for El Niño prediction. Mongolia plans to run a climate model for the lead-time of 1-3 months. Currently only a few NMCs including Japan Meteorological Agency regularly maintain the standard verification for the long-range forecasts, and other NMCs plan to follow the verification scheme proposed by CBS/WMO. A few NMCs including Japan Meteorological Agency and Korea Meteorological Administration regularly provide their long-range products through Internet. WMC-Moscow plans to provide its long-range products on WEB next year. A pilot project so-called APCN (Asia-Pacific economic cooperation Climate Network) is under way with the cooperation from the region for the exchange of long-range forecast products, which could contribute for the development of multimodel prediction system.

2.3 Training and other cooperative activities (see Table 3)

2.3.1 There has been frequent bilateral exchange of visits, fellowships, collaborative research, and training among China, Japan, Republic of Korea and Russian Federation mostly on NWP modeling. It is noted however, that there would be more training events in the region which did not appear in this survey.

2.3.2 The Members had requested more frequent workshop or training seminar on the modeling, nowcasting and ensemble prediction system to be organized in the Region.

2.3.3 More support from other WMCs, RSMCs, or NMCs are desired.
Support from other centers on implementation of automated processing system or utilization of NWP products is required, mostly based on previous two surveys (1997, 2000), in the following areas of:

(a) Numerical wave model for Arabian Gulf (United Arab Emirates);
(b) NWP model, super IBM (Kazakhstan);
(c) Post-processing, nowcasting, and climate prediction from UK, USA or Japan (Maldives);
(d) Ensemble prediction system from Canada (Oman);
(e) Implementation of UKMO model (Qatar);
(f) Regional objective analysis model and graphical display software (Sri Lanka);
(g) Equipment, training and software (Republic of Yemen).

2.3.4 Comments for cooperative activities to improve the GDPFS in RA II
The following comments were made by Members from previous survey (1997), and duplicated herewith for consideration.

(a) Regional data base to be established to provide access to high resolution NWP products from major centers such as ECMWF, EGRR, KWBC, etc. (Hong Kong, China);
(b) Exchange of meteorological software (Macao, China);

(c) Highly equipped and more capable NMCs should assist other NMCs in the region to improve their operational capabilities by providing support in communication and software development (Maldives);

(d) To hold more meetings in RAII in order to improve the accuracy of NWP products. Technical assistance would be required from the specialized GDPFS centers on training on the interpretation of their products. (Saudi Arabia).

2.4. Requirements for additional GPV data (see table 4-6)

2.4.1 Many Members desire to access ECMWF data for more variables and for longer lead-time. There are also many requests for GPV data produced at Bracknell, Tokyo, Washington and some prospective NWP centers. The major purpose of the request is for routine forecasts on short and medium-range, and extended to other applied fields such as aviation, marine, and verification.

2.4.2 Most of members currently receive the GPV data through GRIB format, and it is not clear if the encoding and decoding software for GRIB-2 is used for the exchange of ensemble products and long-range products.

2.4.3 The Republic of Yemen requires Z, U, V, T, TTD, and Pmsl from Japan for general forecasts and aviation through satellite communication (GRID format). Pakistan require an ICAO system SADIS or a workstation to become in line with the GDPFS and RSMCs for reception of the NWP products (2000 survey).

2.4.4 More Members want to receive additional GPV data through Internet or TCP/IP. Currently more than half of the Members, replied to the questionnaire, use Internet as part of the communication means to access the GPV data from abroad (Table 5). In addition, more than two thirds of the Members like to use Internet for getting additional GPV as described in Table 4. The frequently accessed URL address in Table 6 is collected rather poorly, and further survey would be necessary to make the list complete.

2.5 Nowcasting tools and severe weather information

2.5.1 The research and development in the area is quite active among NWP centers, while very few Members reported the current usage and future requirements on the severe weather information.

(a) JMA runs the very-short-range precipitation (0-6hours) forecast system operationally at 30 minutes interval. It consists of two parts, one is the analysis of the initial precipitation field from radar observations calibrated by the rain-gauge observations, and the other is forecasting by the optimal mixture of simple extrapolative forecasts and the meso-scale model precipitation forecasts. JMA is now developing the Object-Oriented Method to improve the nowcast of isolated convective precipitation systems. In addition, JMA adopted the Kalman Filter technique to make the hourly forecast guidance for the minimum visibility, ceiling and wind speed and direction at the airports. JMA is now developing the forecast guidance for the maximum rainfall amount in the sub-prefecture regions using the meso-scale model outputs statistically.

(b) Hong Kong, China uses an automatic linear extrapolation technique to recognize the systematic movement of radar echo corresponding to rainfall area. This technique will be combined with the so-called rapid update cycle for mesoscale model. The technique of radar-based nowcasting system can be transferred to users in Region II on request.

(c) The Republic of Korea was having experiment with AWIPS (developed by FSL/USA) workstation for the nowcasting of heavy rain and other severe weather. In addition, it was also doing research on the three hourly digital forecast for the weather elements such as cloud amount, max/min temperature, chance of fog and thunderstorm based on the statistical interpretation of high-resolution model output.

(d) Russian Federation operates synoptico-statistical interpolation integrated system including both hydrodynamical and statistical approach (from 2000 survey)

2.6 Environmental emergency responses

2.6.1 There is a growing concern on the environmental monitoring and prediction among Members, which covers from air quality (China), dispersion modeling (Hong Kong, China), oil spill prediction (Japan), to Yellow sand (or Asian dust) trajectory (Republic of Korea). It is desired to extend the role of environmental emergency responses in more general context covering air pollution, cross boundary dusts/ fire ashes/ acid rain, etc.

2.7 Computers (Table 7)

2.7.1 Few RSMCs or NMCs (including China, Japan, Republic of Korea) upgraded the computer facilities since the 2000 survey.

3. Recommendation

3.1 NWP models and data assimilation

Fourteen NMCs or RSMCs run or plan to run a global and/ or regional model on operational basis. The number of centers running global model is six, which is steady since 2000. The number of centers running regional model increases from eight to ten since 2000. Five NMCs or RSMCs run the high-resolution models (horizontal resolution less than 20km) for operation or research. One NMC plans to run a high-resolution model. Three NMCs or RSMCs upgraded the resolution of global or regional models along with the computer facilities since 2000. However, more than half of the Members in Region II are not reported to prepare for their own NWP system. Considering that NWP model is the core part of the data processing, it is desired to put more effort on promoting the importance of the NWP and on strengthening the bilateral or regional cooperation for the technical transfer and assistance.

There is a tendency to move from the optimum interpolation scheme to variational schemes for data assimilation in Region II to cope with the rapid progress in remote sensing measurement and other asynoptic observing systems including AMDAR. Since the assimilation of radar and satellite estimates are crucial for the nowcasting and very short-range forecasting, many countries in the Region carry out research focused on this problem. As the variational data assimilation is high technology under progress, it is desired to share the expertise in the Region while utilizing the international cooperation with advanced countries in other Region.

3.2. More GPV data requested

Six Members express desire to receive additional GPV product from ECMWF. Four to six Members hope to get more GPV product from Bracknell or Tokyo or Washington. There are also a few requests to access GPV data from Beijing, Moscow, etc. The requested data has more variables including surface parameters, and longer lead-time than those requested in 2000. It implies that the Members have enhanced their capability to manipulate the GPV data for application in last few years. The applied fields for the GPV data covers from routine forecast, aviation, and marine service to the verification of the forecast. They prefer GRID or GRIB format for the GPV data structure. However, there is requirement to check the user's capability to develop and/ or maintain the software for the exchange of numerical products through GRIB-2 format particularly for the ensemble prediction system outputs and long-range products. It is desired to have a regional database to access the high-resolution model output from WMCs/ RSMCs or leading NMCs.

3.3 Internet

More than two thirds of the Members like to receive additional GPV data through Internet or TCP/IP instead of GTS circuit, which might be in part associated with the massive volume of data to be transferred. One of them likes to receive the GPV data through satellite communication. They prefer GRID or GRIB format for the GPV data structure. Since the ensemble prediction outputs and long-range products are available on the WEB, the instruction for the interpretation of the product and associated standard verification scores are recommended to be provided along with the product.

3.4 Severe weather forecasting

Only a very few Members directly express a need for information on severe weather, while few countries such as Hong Kong, China, Japan, Republic of Korea, and Russian Federation develop their own tools for nowcasting. Instead, many Members plan to build expertise on nowcasting through training seminar or workshop. It is questioned whether the infrastructure for application of high resolution model output, such as communication and database is well established among the NMCs who need those high resolution data from abroad. An alternative approach is to build capacity to manipulate the basic GPV data to derive various stability indices and to interpret them on severe weather forecasting. The training workshops and bilateral exchange of experts are highly recommended to build expertise in this area. Specific products such as helicity, potential vorticity maps may be useful for the weather hazards in the mid-latitude countries, but their value have to be checked in the tropical countries influenced by monsoon. In Region II, both mid-latitude and tropical systems are co-existing, and the Region needs to identify the severe weather systems and approach to Members' support the forecasting technique based on the numerical weather prediction technique or nowcasting tools. Few used certain type of nowcasting tools for the very short-range prediction of tracking severe weather systems. It is desired to have a demonstration project to provide Members the utility and beneficial potential of such tools on operational forecasting of severe weather. It is noted that even high-resolution numerical model products had a certain limitation to simulate the timing and place of severe weather due to uncertainty of initial condition and incompleteness of model physics. The role of human forecaster should not be underestimated. On the contrary, it is recommended to develop conceptual models based on the intense observation project through the cooperation among Members. The outcome from the observation study provides directions for the improvement of numerical models and conceptual framework for the interpretation of numerical model output.

3.5 Ensemble Prediction System (EPS)

There is a growing interest on EPS in region II. Four Members are running EPS for operation or research in the Region. One Member plans to run EPS through bilateral collaboration. Six Members participated or want to attend international workshop or training seminar on EPS (from 2000 survey). Thus, it is desired to establish an appropriate infrastructure for the dissemination or reception of the EPS output. In the meantime the development in this area is rather new, model intercomparison project is desired to exchange expertise and/or experience. In addition, more effort would be desired to provide educational opportunity on EPS and its application. As the various training workshops for the forecasters and model developers will be arranged by WMO, the Members are recommended to utilize such opportunity for the capacity building. Particularly, the users of ensemble prediction system have to be well aware of using probability forecasts for risk management, and education need to be focused in part on the interpretation of probabilistic forecasts. More research is put on the short-range ensemble forecasting and support for severe weather forecasting and the operational community need to have a keen interest to benefit from the academic findings.

3.6 Downsizing NWP system

Workstations (WSs) or personal computers (PCs) are widely used in the Region for the wide range of functions covering pre/post processing, global and/or regional model, interactive display, nowcasting processing. Two more Members run regional models with PCs after 2000 survey. Few more Members have a plan to run a limited are model with PCs through the technical collaboration with other RSMCs or NMCs. WSs or PCs are economical and still fast enough to run NWP models. It is desired to encourage those Members, who do not yet have their own NWP system, to actively implement a NWP system on WSs or PCs, and to build expertise through the international workshop for the implementation of limited area model on WSs or PCs in conjunction with other regional association. The bilateral cooperation would be particularly useful for the technical transfer in this area. The various projects planed by Nepal, Mongolia and other countries may provide insights for those countries that plan to build NWP system in PCs.

3.7 Long-range prediction

There is a growing interest on climate prediction among NWP centers. Four Members run a kind of climate model in operation and/or research, and one Member runs coupled GCM. It is desired to share expertise and simulation result to reduce uncertainty involved in climate modeling and prediction. It is highly recommended to maintain the standard verification system for the users to understand the limitation and value of the products.

3.8 Environmental Emergency Responses

The exercise on the exchange of trajectory model output is reported to be very useful to get acquainted with the preparation and preventive measures for the possible nuclear accidents. There is a growing interest on other environmental hazards including chemical spill, transboundary air pollution, etc. It is desired that the scheme extend to cover more broad environmental problems at hand. Some environmental issues, shared by neighboring countries, could benefit from regional support on the exchange of transport model products in the limited scale.

3.9 Technical Transfer

There is a flow of technical transfer from the advanced RSMCs or NMCs to the developing NMCs. However, more cooperation is required for the technical assistance and exchange of expertise through bilateral arrangement and / or international workshops. The list of resource persons or contact points might be an useful starting point for stimulating Members to communicate directly with the counterparts or experts in the specialized areas on NWP (see Table 8) via Internet. In addition, the rapporteur propose an E-mail group, which consists of representatives nominated from each Member, for intense discussion and feedback on NWP matters among Members.

3. 10 Other issues

Parallelization techniques are widely used and expanded in various modeling activities to enable data processing on multiple processors or clusters, depending on the architecture of the computer system. Already the leading centers in this Region had developed codes on parallel machine, and others plan to do so. It is desired in this region to draw attention to the importance of this technology for the future.

As a separate issue, the computer aided learning (CAL) modules are rapidly developing under WMO programme. It is desired to distribute the developed CAL modules in the Region under the support of WMO programme, and to maintain the opportunity to use them for education and capacity building on various subjects including ensemble prediction system.

References:

WMO, 2002: Final Report, Meeting of Implementation Coordination Team on Data Processing and Forecasting Systems, Moscow, 3-7 June 2002.
WMO, 2002: WWW Technical Progress Report on the Global Data Processing System. GDPFS Technical Progress Report Series No. 12, WMO/TD-No. 1148.
WMO, 2002: Proceedings of Technical Conference on Data Processing and Forecasting System. Cairns, December 2002.
WMO, 2002: Documents, CBS Extraordinary Session, Cairns, 4-12 December 2002
WMO, 2003: Documents, Congress XIV, Geneva, 5-24 May 2003

TABLE 1 – Top five priorities in NWP (June 2003)

Country	**First**	**Second**	**Third**	**Forth**	**Fifth**
China	3DVAR, Climate model	Asynoptic data assimilation	PBL/ soil process	Cloud parameterization	Typhoon bogus
Hong Kong, China	Variational data assimilation of asynoptic data	Frequently updated high-resolution local analysis for nowcasting	High-resolution non-hydrostatic model	Ensemble with regional model	Model post-processing
Japan	Semi-Lagrangian numeric for global model	Nonhydrostatic mesoscale model	Physical processes of global model	4DVAR for global model	Assimilation of Micro-wave radiance data from satellite
Republic of Korea	3DVAR	Assimilation of satellite radiance	3DVAR with radar reflectivity	Precipitation physics	Ensemble with regional model
Macao, China	MM5	Wave Model			
Qatar	Implementation of UKMO model	Implementation of wave model			
Russia	Ensemble system for short and medium-range NVP	NWP of sensible weather	Semi-Lagrangian numeric for global model	4DVAR with Kalman filter	Severe weather prediction using regional and nonhydrostatic mesoscale model model
U.A.E.	Limited area model	Meso-scale model	Wave model		
Vietnam	LAM with several initial and boundary data	Non-hydrostatic LAM	3 DVAR		

TABLE 2 - STATUS OF RSMCs AND NMCs RELATIVE TO NUMERICAL MODELS (June 2003)

						DISSEMINATION			
CENTRE	***STATUS***	***MODELS***	***RESOL.***	***LEVELS***	***RANGE***	***GTS***	***FAX***	***SATELLITE***	***SPECIAL***
BANGKOK	NMC	GM	100 km	19	72 h				
		LAM	50 km	19	72 h				
		MSM	17 km	31	36 h				
BEIJING	Geo. And Transport Model (T.M.) RSMC	AGCM/OGCM	T106	30	30 days				
		GM	T213	31	10 days	GTS	Fax	SAT	
		Ens. 32 members	**T106**	**19**	10 days				
		LAM-(HLAFS)	0.25°	20	48 h				
		LAM-(MTTP). Tropical	50 km	15	48h				
		AQM	54km		24 h				Air quality
HANOI*	NMC	**LAM**	**28km**	**20**	**72 h**				
HONG-KONG	NMC	AGCM	15 km	18	84 days				Experimental
		LAM (ORSM)	20 km / 60 km	36	42 h / 72 h				
		MSM (ARPS)	6 km / 30 km	40	12 h / 30 h				Operational trial
		Nowcasting (LAP S)	1 km/5 km	21					Operational trial
		Dispersion model	1 km	20	42 h				Experimental
JEDDAH*	NMC	**LAM**	**48 km**	**48**	**48 h**				
KHABAROVSK*	Geo. RSMC	LAM	100 km	11	48 h		Fax		

MACAO	NMC	LAM	54/18km	22	60 h				
MOSCOW	NMC	GM	T85	31	4 / 10 days	GTS	FAX		INTERNET
		LAM	75 km	30	48 h				Local net
		MSM	10 km	21	36 h				Local net
		ENS, 10 members	T40	15	100 days				experimental
NEW DELHI*	Geo. and T.C. RSMC	full access to GM (NCMRWF)	T63	16		GTS	Fax		
		LAM (LAFS)	1°	12	48 h				
		LAM (nested)	0.5°	16	48 h				
NOVOSIBIRSK*	Geo. RSMC	LAM	40 km	15	48 h		Fax		
OMAN*	NMC	LAM	28 km	20	48 h				
		MSM	7 km	20	48 h				
PYONGYANG*	NMC	LAM							
SEOUL	NMC	AGCM	T106	21	180 days				
		GM (GDAPS)	**T213**	**31**	**240 h**			3DVAR in parallel run	
		Ens. 17 members	**T106**	**21**	**10 days**				
		Ens. 20 members	T106	21	130days				
		Ens. 20 members	T106	21	7month				
		MSM (RDAPS)	**30/10/5 km**	33	48 h			Quikscat, Radar, ATOVS, AWS with 3DVAR in parallel run	4 runs per day under test
		Yellow sand trajectory model			5 days			Density of pollutants are also predicted	
TEHRAN*	NMC	LAM							
TOKYO	Geo.-T.M. and T.C. RSMC	AGCM/OGCM	T42/ 200km	40/ 20	525 days				
		GM (GSM)	T213	40	216 h	GTS	Fax		RSMC Tokyo DSS
		Ens. 25 members	T106	40	216 h				RSMC Tokyo DSS

		Ens. 26 members	T106	40	One month				TCC/JMA website
		Ens. 31 members	T63	40	4 months				TCC/JMA website (in 2003)
		LAM (RSM)	20 km	40	51 h				
		MSM (MSM)	10 km	40	18 h				
		Typhoon (TYM)	24 km	25	84 h				
		Global wave model	1.25 degrees		216 h	GTS			RSMC Tokyo DSS
		Coastal wave mod el (around Japan)	0.1degrees		84h				
		Dispersion model for EER			72h				
		Oil spill model	2-20km		8days				
ULAANBATAR	NMC	LAM							

GM = Global Model; LAM = Limited Area Model; MSM = Meso Scale Model (resolution higher than 20 km), Ens: Ensemble Prediction System
* Use of W/S or PC for running NWP model

Table 3: Opportunity for education, training, and/or technical assistance on GDPFS (June 2003). The future demand is highlighted in bold character. The Members are invited to update the Table.

Recipients	Modes (1)	Hosts	Subject (2)	Year and period	Fund source	Remark
Bahrain	**WS, TS**		**SI, EPS**	**2003-2005**	**Bahrain/WMO**	**CLICOM 6 persons**
China	F	Rep. Korea	TMO	2001-2002 (6 months)	KMA through Typhoon Committee	TC research fellowship scheme
	F	Japan	MO	14 Feb - 13 Mar	Japan	
Hong Kong, China	**G, T, C, E, WS, TS**	**China, Japan, USA**	**PR, MO, NT**	**P(2002-05)**	**Hong Kong Observatory**	**2-3 persons**
	T	Japan	MO	4 Feb. -7 Mar. 2003	Hong Kong Observatory	
	T	JMA/Japan	MO	3 Feb – 8 Mar 2003	Hong Kong Observatory	1 person
	T	FSL/USA	NT	10 Feb – 19 Apr 2003	Hong Kong Observatory	1 person
	G, T, C, E, WS, TS	**China, Japan, USA, ECMWF**	**PR, MO, NT, PO**	**P(2003-06)**	**Hong Kong Observatory**	**2-3 persons**
	T	JMA/Japan	MO	3 Feb – 8 Mar 2003	Hong Kong Observatory	1 person
Republic of Korea	T	Japan	MO	27 -31 Oct. 2003	KMA	
	T	JMA/KMA	MO	25-29 Aug. 2003	KMA	
	T	JMA/KMA	MO	23-27 Jun. 2003	KMA	
	T	Japan	MO	16 Jun. -11 Nov. 2003	KMA	
	T	JMA/KMA	MO, EPS	7-10 Oct. 2002	KMA	
	T	JMA/KMA	MO	15-19 Jul. 2002	KMA	
	T	Japan	MO	1 Jul. -29 Jul. 2002	KMA	
	T	Japan	MO	6 Jun. -3 Jul. 2002	KMA	
	T	Japan	MO	28 May - 1 Jun 2001	KMA	
	T	Japan	MO	4 - 15 Jun 2001	KMA	
	T	Japan	MO	10 - 20 Sep 2001	KMA	
	T	Japan	MO	Nov 2001 - May 2001	KMA	
	T	JMA/KMA	MO	5-9 Nov 2001	KMA	
	T	JMA/KMA	MO	27 Aug - 1 Sep 2001	KMA	
Maldives	**G, T, E**		**PO, NT**	**2002-2003**	**WMO/ others**	**Computer/ 4 persons**
	WS, TS		**EPS**	**2002-2003**		**Software**

Mongolia	**Training/ fellowship**		**Data assimilation**	**2002-2004**		
	training		**Dynamic interpretation**	**2002-2003**		
	training		**Long range weather forecast methods**	**2002-2003**		
	F	Rep. Korea	MO	2002 Feb.-Apr.	KMA through VCP	MM5 model on PC platform
Russian Federation	C, E	Rep. Korea	MO	2002 (3 months)	KMA	Wave Modeling
Thailand	F	Japan	MO	17 Jan - 13 Feb, 2002	Japan	
U.A.E	**WS**		**MO**	**2004**		**3 persons**
	TS		**NT**	**1-2 weeks**		
Vietnam	WS, TS	Japan, Hong Kong, Korea	PR (2 persons), NT (2 persons), TMO (2 persons)	2003 - 2005		

(1) G=general assistance including hardware, T=technical transfer by bilateral arrangements, C= collaborating research, F=fellowships for research, E=exchange of visits, WS=workshop, TS=training seminar

(2) PR=pre-processing, MO=modeling, TMO= tropical cyclone modeling, PO=post-processing, NT=nowcasting technique, SI= statistical interpretation, EPS= ensemble prediction system for medium and/or long-range, CP=climate prediction, etc.

Table 4. Output Products Required from Other GDPFS Centers (June 2003). (*) indicates information from 2000 survey.

Producer (1)	Product Species (2)	Parameters (Element & level) (3)	Range (forecast hours)	Area	Used For (4)	Method of Transmission (5)	Code Form (6)	Requested from
Bracknell	A, F	P0, H, U, V, RH for all mandatory levels	168 hours	global	R, VR	IT	GRIB	Republic of Korea
Bracknell	F	U, V, T	48, 72	E-Asia	R, AV	IT	GRID	Maldives
Beijing	S	Us, Vs	72 hours	70N-20N, 60E-160W	R	IC/ IT	GRID/ GRIB	Mongolia
Beijing	F	T, rainfall	10 days	70N-20N, 60E-160W	R	IC/ IT	GRID/ GRIB	Mongolia
Bracknell	F	Us, Vs, PoP, wave height	6-72 hours	Gulf	R, MR	IC, IT	GRIB	U.A.E
Bracknell	A & F	P, Z, T, U, V	00-24 00-120 00-120		R	IC	GRID	Uzbekistan*
ECMWF	A, F, EP	U,V,T,RH,rainfall for all mandatory levels	00,24,48,72,96,120,144,168	0-90N, 90E-180E	R, AV, TC	IC	GRIB	Hong Kong, China
ECMWF	A, F	P0, H, U, V, RH, rainfall, for all mandatory levels	168 hours	global	R, VR	IT	GRIB	Republic of Korea
ECMWF	A, F	P0, H, U, V, RH for all mandatory levels	96 hours	global	R	IC, IT	GRIB	Mongolia
ECMWF	A, F	P0, Z500, T850	168-240	N. Hemisphere	R, VR	IC	GRIB/ GRID	Russia
ECMWF	F	all	5 days	global	R, AV	IT	GRIB	Saudi Arabia
ECMWF	F	Us, Vs, PoP, wave height	6-72 hours	Gulf	R, MR	IC, IT	GRIB	U.A.E

ECMWF	A, F	T, U, V, QV, QC, QI for all levels, PS, t_g1, t_g2, t_g3, t_g4, w_g1,w_g2, w_g3,w_g4, w_snow, w_i, t_s,t_snow, g20,FR_LAND, FIS, PLCOV, PLTYP, LSM	6 - 72 hours	20S - 60N, 60E - 160E	R, TC	IT	GRIB	Vietnam
MDD	A & F	PoP	12,24,36,48,72,96,120	0-90E, 0-60N	EH, HD, AG, BN,	ST	A/N, GRID	Kuwait*
Moscow	A & F	P, Z, T, U, V	00-24 00-120 00-120		R	IC	GRID	Uzbekistan*
Tokyo	A & F	Psea, T850, U,V850, H500	00,24,48,72,96	Northern Hemisphere	forecast	IC, PP	GRID	Kazakhstan*
Tokyo	A & F	Z, T, Precip	00-48		VR	IT		Korea (Rep.)
Tokyo	F	all	00-72	5-45N,90-150E	R	IT	GRIB	Macao, China
Tokyo	A, F	(sea, T, U, V)* (850, 700, 500)	72 hours	Gulf	R	IC		Qatar
Tokyo	F	all	5 days	global	R, AV	IT	GRIB	Saudi Arabia
Toulouse	F	all	5 days	global	R, AV	IT	GRIB	Saudi Arabia
Washington	F	D,Z,T,U,V	12,24,36,48,72, 96,120 hrs	00--90E 20N--90N	R, AV EH, MR, AG	RF	GRID	Iran*
Washington	A	P0, H, U, V, RH for all mandatory levels	168 hours	global	R, VR	IT	GRIB	Republic of Korea
Washington	F	Psea, Z500	24, 36, 48, 72, 96, 120, 144		R	IT	FTP	Kyrgyz*
Washington	F	P0, H, U, V, RH for all mandatory levels	96 hours	global	R	IC, IT	GRIB	Mongolia

Washington KWBC	F	(Z,U,V,T,TTD,OMG) (850 - 100)	24,48	Global	R, AV	PP	GRID GRIB	Sri Lanka*
Washington	A & F	P, Z, T, U, V	00-24 00-120 00-120		R	IC	GRID	Uzbekistan*

(1) Center at which product is produced

(2) A=analysis, F=forecast, S=severe weather information. For ensemble prediction system output, EA=all ensemble information, EM= ensemble mean, ES= spaghetti plots, and EP= probability charts

(3) Meteorological Elements such as Psea, Z=geopotential height, T=Temperature, U,V=Wind components, TTD=(T-Td), VOR=Vorticity, OMG=Vertical wind velocity, Others and pressure levels (for example Z500, T850, OMG700 etc. or (Z,U,V,T,TTD) *(850,700,500,300))

(4) R=Routine weather forecast, TC=Tropical cyclone, EH=Environmental hazards, VR=Verification, MR=Marine, AV=Aviation, HD=Hydrology, AG=Agrometeorology, BN=Boundary values of limited area models, Others

(5) IC=international circuit on lease (GTS), PP=point-to-point communication excluding GTS, IT=internet or TCP/IP, ST=satellite communications, RF=radio fax, Others.

(6) A/N, GRID, GRIB, FAX, Others

Table 5. Providers of products that RA-II Members currently receive (June 2003)

Provider of products	Recipients
Bracknell	**Bahrain**, Hong Kong, China, Iran*, Kyrgyz Republic*, **Maldives**, Oman*, Russian Federation
ECMWF	**Bahrain**, China, Hong Kong, China, Japan, Kazakhstan*, **Republic of Korea**, Kuwait*, Macao, China, Maldives, Mongolia**,** Russian Federation, **Saudi Arabia**, Sri Lanka*, Thailand, **U.A.E.**
Melbourne	**Vietnam**
Moscow	Kyrgyz Republic*
New Delhi	**Qatar, Saudi Arabia**
Offenbach	Oman*, **Russian Federation, U.A.E., Vietnam**
Tokyo (JMA)	China, Hong Kong, China, **Republic of Korea**, Macao, China*, **Maldives**, Macao, China, **Mongolia**, Qatar, Thailand, **Vietnam, Republic of Yemen, Russian Federation**
Toulouse	Oman*
Washington	China, **Hong Kong, China**, Japan, Kazakhstan***, Republic of Korea**, **Maldives**, **Mongolia**, **Russia Federation, Saudi Arabia, U.A.E.**

- (*) indicates information from the previous survey in 2000.
- Bold faced denotes a country which uses Internet for communication along with/ without GTS.
- (_) denotes using satellite communication as well

Table 6. Some of frequently Accessed Internet Address (June 2003). The Members are invited to update the Table.

Producer	Address	Model	Purpose	Clients
BoM	ftp.bom.gov.au		Short-range	Vietnam)
DWD	www.wetterzentrale.de fsmrfeur.html http://hmc.hydromet.ru		Short/ medium-range	Russian Federation
ECMWF	www.ecmwf,int		Medium-range	Saudi Arabia, Vietnam(S.R.)
ECPC (USA)	ecpc.ucsd.edu www.cpc.ncep.noaa.gov	ECPC GSM	Long-range	Hong Kong, China, Republic of Korea, Saudi Arabia
ENDIA	www.ncmrwf.gov.in		Medium-range	Saudi Arabia, Qatar
FNMOC	www.fnmoc.navy.mil	NOGAPS	Short-range	Republic of Korea)
JMA	ddb.kishou.go.jp	GSM	Short/ medium- range	Republic of Korea, Mongolia, Vietnam
	Cpd2.kishou.go.jp/tcc/products/model/index.html	GSM	Long-range	NHMSs in region II
JTWC	www.npmoc.navy.mil/jtwc.html	NOGAPS	Typhoon tracks	Republic of Korea
KMA	www.apcn21.net		Long-range	NHMSs in APEC member economies
NCEP	ftp.necp.noaa.gov tgftp.nws.noaa.gov www.weather.noaa.gov	AVN, MRF, ETA	Short/ medium-range	Hong Kong, China, Republic of Korea, Macao, China, Russian Federation, Saudi Arabia, Vietnam
WSI*	Wsi-pilotbrief-net.com	ECMWF	Short-range	Maldives

TABLE 7 - COMPUTERS USED FOR DATA PROCESSING AT RSMCs AND NMCs (partially updated in June 2003)

CENTRE	*MAINFRAME (number cruncher)*	*SECONDARY COMPUTER(S)*	*WORK STATIONS*
ALMATY			PCs
BANGKOK	SP2	DATA GEN. MV7800 - 2 HP9000	
BEIJING	IBM SP, SW-1, YH3	CRAY J90 - CRAY EL 98/4 – IBM SP2/32 – 2 ALPHA 1000 – 2 ALPHA 4000	WSs
HANOI	IBM RS/6000, PC clusters (4 PC)		
HONG-KONG	IBM SP, IBM p690, CRAY SV1-1 A	SGI Origin 2000, 2 SUN E450, 2 SGI O2	WSs
JEDDAH		CDC CYBER 962 – 2 CDC 910	3 SG – 4 VAX – 3 CDC
KARACHI			PCs
KHABAROVSK		COMPAREX 8/830	PCs
Macao, China	SUN E5500	Linux Cluster	PCs
MOSCOW	CRAY YMP8E	4*4 Itanium-2	PCs, HPs
NEW DELHI	CDC CYBER 2000U	CDC 4680	CYBER 910-484 WSs - VAX 3400 - 2 VAX 11/750
NOVOSIBIRSK		COMPAREX 8/830	PCs
OMAN	SUN E450 HPC		
PYONGYANG		EC-1055M - IBM370/148	PC/AT – PS/2
SEOUL	NEC SX-5/28M2	NEC SX-4/2A, HP V2500(48PE)	SUN 2000
TASHKENT		IBM 370 (2 4381 P13)	PCs
TEHRAN			PCs 486
TOKYO	HITACHI SR8000 E1/80	HITACHI 3500/ E540PS	HITACHI 3050RX WS s
ULAANBATAR			MICRO VAX 3400

Table 8: Resource persons or contact points for NWP and its application (June 2003). This list could be used for the direct communication among experts in specialized fields via Internet. The Members are invited to update the Table.

Field	Country	Name	Title and affiliation	E-mail address	Remark (specialties)
General	Japan	Hajime Nakamura	Director, NPD/JMA	hnakamur@npd.kishou.go.jp	NWP modeling
	Japan	Hisashi Nakano	Chief, NWP system management section, NPD/JMA	nakano@met.kishou.go.jp	NWP system & products
	Japan	Yoshinori Yamada	Senior Coordinator for Numerical Weather Prediction Modeling, NPD/JMA	yyamada@npd.kishou.go.jp	Mesoscale
	Japan	Tomoaki Ose	Senior Coordinator for climate modeling, CPD/JMA	t-ose@met.kishou.go.jp	Extended/long range
	Japan	Yoshiteru Kitamura	Senior Assistant for El Nino monitoring and prediction, CPD/JMA	ykitamur@met.kishou.go.jp	Coupled GCM
	Macao, China	Ku Chi Meng	Chief of Processing and Telecommunication Center	cmku@smg.gov.mo	NWP modeling NWP products Extended/long range Coupled GCM
Model Numeric	China	Qingquan Li	Associate Prof. Dyn. Clim. Div./ NCC/ NMC	Liqq@cma.gov.cn	Global
	China	Zuqiang Zhang	Associate Prof. Dyn. Clim. Div./ NCC/ NMC	Zuqiangzhang@263.net	Global
	China	Guoquan Hu	Assistant Prof. Dyn. Clim. Div./ NCC/ NMC	hugg@163.net	Regional
	China	Yiming Liu	Associate Prof. Dyn. Clim. Div./ NCC/ NMC	yimeiu@163bj.com	Regional
	China	Qiying Chen	Engineer NWPD/NMC/CMA	chenqy@cma.gov.cn	
	China	Zhihui Yan	Prof. NWPD/NMC/CMA	yanzh@cma.gov.cn	
	Japan	Kazuo Saito	Chief, Modeling Section, NPD/JMA	ksaito@npd.kishou.go.jp	Mesoscale
	Japan	Takayuki Matsumura	Leader, Global and Typhoon Modeling Group, NPD/JMA	matumura@npd.kihou.go.jp	Global
	Japan	Tsukasa Fujita	Leader, Mesoscale Modeling Group, NPD/JMA	fujita@npd.kishou.go.jp	Mesoscale
	Republic of Korea	Hoon Park	Assistant Director NWPD/KMA	hoon@kma.go.kr	Global
	Republic of Korea	Ye-Sook Lee	Meteorologist NWPD/KMA	lys@kma.go.kr	Regional
	Republic of Korea	Kwan-Young Chung	Senior Researcher, NWPD/KMA	kychung@kma.go.kr	Global numerics
	Republic of Korea	Jong-Khun Kim	Senior Researcher CPD/KMA	kjk@kma.go.kr	Global
	Saudi Arabia	Saad Muhlafi	Doctor	www.mwpa.sa.org	Global
	Russian Federation	Rozinkina I.	Dr. RHMC, Lab of meduim range NWP	inna@rhmc.mecom.ru	Global
	Russian Federation	Frolov A.	Dr. RHMC, Lab of meduim-range NWP	afrolov@mecom.ru	Global
	Russian Federation	Tolstykh M.	Dr. RHMC, Lab of meduim-range NWP	tolstykh@rhmc.mecom.ru	Regional
	Russian Federation	Losev V.	Dr.RHMC, Lab of regional NWP	losev@rhmc.mecom.ru	Mesoscale
	Russian Federation	Pressman D.	Dr. RHMC, Lab of regional NWP	pressman@rhmc.mecom.ru	

Physical Parameterizations	China	Yiming Liu	Associate Prof. Dyn. Clim. Div./ NCC/ NMC	yimeiu@163bj.com	Convection
	Japan	Hiroto Kitagawa	Forecaster, NPD/JMA	kitagawa@npd.kishou.go.jp	Radiation, PBL
	Japan	Akihiko Shimpo	Chief of Climate Modeling Section, CPD/JMA	sinpo@met.kishou.go.jp	Convection
	Republic of Korea	Byung-Kwon Park	Meteorologist NWPD/ KMA	bbk@kma.go.kr	Surface layer Biosphere
	Republic of Korea	Jong-Khun Kim	Senior Researcher CPD/KMA	kjk@kma.go.kr	
	Saudi Arabia	M. Siami, J. Bantan		www.mwpa.sa.org	Convection
	Russian Federation	Pressman D.	Dr. RHMC, Lab of regional NWP	pressman@rhmc.mecom.ru	Radiation
	Russian Federation	Pressman D.	Dr. RHMC, Lab of regional NWP	pressman@rhmc.mecom.ru	
	Russian Federation	Astakhova H.	Dr. RHMC, Lab of meduim-range NWP	helen@rhmc.mecom.ru	
	Russian Federation	Dmitrieva L.	Dr. RHMC, Lab of meduim-range NWP	dmitrieva@rhmc.mecom.ru	Boundary layer
	Russian Federation	Berkovich L.	Dr. RHMC, Dep.of short-range NWP	berkovich@rhmc.mecom.ru	
	Russian Federation	Rozinkina I.	Dr. RHMC, Lab of meduim-range NWP	inna@rhmc.mecom.ru	
Satellite data assimilation	Japan	Yoshiaki Takeuchi	Leader, Satellite Group, NPD/JMA	takeuchi@npd.kishou.go.jp	
	Republic of Korea	Sang-Won Joo	Researcher of NWPD	jsw@kma.go.kr	
	Russian Federation	Uspensky A.	Dr. SRC Planeta	uspensky@planet.iitp.ru	
Radar data assimilation	Japan	Ko Koizumi	Leader, Analysis Group, NPD/JMA	kkoizumi@npd.kishou.go.jp	
	Republic of Korea	Eunha Lim	Researcher of NWPD	ehlim@kma.go.kr	
	Russian Federation	Pressman D.	Dr. RHMC, Lab of regional NWP	pressman@rhmc.mecom.ru	
Variational data assimilation	China	Yiming Liu	Associate Prof. Dyn. Clim. Div./ NCC/ NMC	yimeiu@163bj.com	4DVAR
	China	Gang Zhao	Engineer NWPD/NMC/CMA	zhaog@cma.gov.cn	3DVAR
	Japan	Ko Koizumi	Leader, Analysis Group, NPD/JMA	kkoizumi@npd.kishou.go.jp	4DVAR
	Republic of Korea	Hyun-Cheol Shin/	Researcher/	sinhyo@kma.go.kr/	3DVAR/ 4DVAR/
	Republic of Korea	Eun-Ha Lim	Assistant Director	ehlim@kma.go.kr	3DVAR/ 4DVAR
	Republic of Korea	Sang-Won Joo	Researcher of NWPD	tsyrulnikov@rhmc.mecom.ru	1DVAR
	Russian Federation	Tsyrulnikov M.	Dr. RHMC, Lab.of objective analysis		3DVAR/
Objective analysis schemes	China	Ming Hao	Senior Engineer NWPD/NMC/CMA	haom@cma.gov.cn	3D OI
	Hong Kong, China	Queenie C.C. Lam	Scientific Officer Hong Kong Observatory	cclam@hko.gov.hk	3D OI
	Republic of Korea	Jeong-Seok Ko	Meteorologist of NWPD	kjs@nwpsvr.kma.go.kr	3D OI
	Russian Federation	Bagrov A.	Dr. RHMC, Lab.of objective analysis	bagrov@rhmc.mecom.ru	3D OI

Statistical Interpretation	China China Japan Republic of Korea Russian Federation Russian Federation Russian Federation Russian Federation	HuanZhu Liu Sheng rong Zhao Youichi Kimura Young-Kyung Seo Vasiliev P. Tsyrulnikov M. Rubinstein K. Kiktev D.	Prof. WFO/NMC/CMA Dr. WFO/NMC/CMA Technical officer, NPD/JMA Researcher Dr. RHMC Dr. RHMC, Lab.of objective analysis Dr. RHMC Dr. RHMC	Liuhz@cma.gov.cn Zhaosr@cma.gov.cn ykimura@met.kishou.go.jp seo@kma.go.kr vasiliev@rhmc.mecom.ru tsyrulnikov@rhmc.mecom.ru rubin@mecom.ru kiktev@rhmc.mecom.ru	PPM Kalman PPM/ Kalman/ Neural networks/etc
Typhoon Model	China Japan Republic of Korea	Su hong Ma Ryouta Sakai Jang-Ho Lim	Senior Engineer NWPD/NMC/CMA Technical officer, NPD/JMA Meteorologist of NWPD	Suhong0288@hanmail.com Ryouta-sakai-a@met.kishou.go.jp jhlim@kma.go.kr	Model/ Bogusing
Wave Model	Japan Russian Federation Russian Federation	Tetsuya Mikawa Abuziarov Lavrenov V.	Senior Scientific Officer, Office of Marine Prediction/ JMA Dr. RHMC, Lab.of objective analysis Dr. AARI	mikawa@met.kishou.go.jp lavren@aari.nw.ru	
Nowcasting Tools	Hong Kong, China Saudi Arabia Russian Federation	P.W. Li M. Babidan, A. Mudarees Liakhov A.	Scientific Officer Hong Kong Observatory Dr. MHMB	pwli@hko.gov.hk www.mwpa.sa.org mhmb@hydromet.ru	AWS/ Radar/etc AWS/ Radar/etc
Decoding/ Encoding message	Japan China Saudi Arabia Russian Federation	Kouji Yamashita Jianming Zhuang S. Habis Jabina I..	Scientific Officer,NWP NPD/JMA Senior Engineer NWPD/NMC/CMA RHMC, Dep.of automatic information adaptation	kobo.yamashita@met.kishou.go.jp Zhuangjm@cma.gov.cn www.mwpa.sa.org jabina@rhmc.mecom.ru	 Grid/ BUFR Grid/ BUFR
Quality Control of Synoptic and asynoptic data	China Saudi Arabia Russian Federation Russian Federation Russian Federation	Shi Wei Tao T. Eshmawei, A. Gulam Bagrov A. Svirenko P. Tsyrulnikov M.	Senior Engineer NWPD/NMC/CMA Dr. RHMC, Lab.of objective analysis Dr. RHMC, Lab. of meduim range NWP Dr. RHMC, Lab.of objective analysis	taosw@cma.gov.cn www.mwpa.sa.org bagrov@rhmc.mecom.ru svirenko@rhmc.mecom.ru tsyrulnikov@rhmc.mecom.ru	SYNOP/SHIP/AIREP SYNOP Satellite Satellite
Visual Display System	China Hong Kong, China	Sun chu rong W.M. Ma Alferov Y	Associate Prof. Dyn. Clim. Div. NCC/NMC Senior Scientific Officer Hong Kong Observatory RHMC, Lab of meduim range NWP	sunchu@sina.com wmma@hko.gov.hk alferov@rhmc.mecom.ru	 NWP data visualization

Ensemble Prediction System	China China Japan Japan Republic of Korea Republic of Korea Russian Federation Russian Federation Russian Federation	Zhang Peiqun Hua Tian Masayuki Kyouda Yasuhiro Matsushita Deuk-Kyun Rha Nam-Young Kang Muravev A. Rozinkina I. Astakhova H.	Associate Prof. Dyn. Clim. Div. NCC/NMC Engineer NWPD/NMC/CMA Technical officer, NPD/JMA Senior Scientific Officer, CPD/JMA Senior Researcher of NWPD Researcher, CPD/KMA Dr. RHMC, Dep.of extended range NWP Dr. RHMC, Lab of meduim range NWP Dr. RHMC, Lab of meduim range NWP	Zhangpq @ cma .gov .cn b-tianhua@hotmail.com kyouda@naps.kishou.go.jp y-matsushita@met.kishou.go.jp dkrha@kma.go.kr kny@kma.go.kr muravev@mecom.ru inna@rhmc.mecom.ru helen@rhmc.mecom.ru	
Verification	China Japan Russian Federation	Junying Zhao Shuhei Maeda Buldovsky G.	Senior Engineer NWPD/NMC/CMA Forecaster, CPD/JMA Dr. RHMC, Dep.of automatic information adaptation	zhaojy@cma.gov.cn smaeda@met.kishou.go.jp buldovsky@rhmc.mecom.ru	Extended/long range
Diagnostic of Model Errors	China Russian Federation	Guo quan Hu Kiktev D.	Assistant Prof. Dyn. Clim. Div. NCC/NMC Dr. RHMC, Deputy director	hugq@163.net kiktev@mecom.ru	Systematic approach/ etc
Application on Forecasting	Japan Hong Kong, China Saudi Arabia Russian Federation	Shingo Yamada Edwin S.T. Lai H. Mira, S. Abuhomaidi Shakina N.	Chief, application section, NPD/JMA Senior Scientific Officer Hong Kong Observatory Dr. RHMC, Dep. of forecasts for aviation	shingo.yamada@met.kishou.go.jp stlai@hko.gov.hk www.mwpa.sa.org shakina@rhmc.mecom.ru	Short/ Medium range
Model in personal computer	Republic of Korea Saudi Arabia Russian Federation Russian Federation Russian Federation	Yong-Hee Lee M. Badidan, B. Khyat Svirenko P. Stepanov Y. Astakhova H.	Researcher of METRI/ KMA Dr. RHMC, Lab of meduim range NWP RHMC, Dep.of automatic information adaptation Dr. RHMC, Lab of meduim range NWP	yhlee@metri.re.kr www.mwpa.sa.org svirenko@rhmc.mecom.ru stepanov@rhmc.mecom.ru helen@rhmc.mecom.ru	
Product Generation on WEB	China China Hong Kong, China Japan Russian Federation Russian Federation	Sun Chu Rong Song Yongjia W.M. Ma Hiroshi Nirasawa Lubov S. Kiktev D.	Associate Prof. Dyn. Ckim. Div. NCC/NMC Assistant Prof. Dyn. Ckim. Div. NCC/NMC Senior Scientific Officer Hong Kong Observatory Senior Scientific Officer, CPD/JMA Dr. Main Computing Center of Roshydromet Dr. RHMC, Deputy director	sunchurong@sina.com songyj@cma.gov.cn wmma@hko.gov.hk nirasawa@met.kishou.go.jp loubov@hydromet.ru kiktev@mecom.ru	world city forecasts and s evere weather TCC/JMA web-site

Appendix A: Contents of long-range dynamic prediction at some Web sites in region II

Table A.1. Contents of one-month ensemble prediction products at TCC/JMA Web site available from September 2003.

(a) Map

	Forecast period	Parameter
Ensemble mean	Day 2–8, day 9–15, day 16–29, day 2–29	Geopotential height and anomaly at 500hPa,temperature and anomaly at 850hPa,sea level pressure and anomaly
Spread (Standard deviation) among time averaged ensemble member forecasts		Geopotential height at 500hPa
Large anomaly index*		
Time-longitude cross section	7-day running mean	Velocity potential at 200hPa averaged in the equatorial region (from 5N to 5S)
Time sequence		Several circulation indices

Large anomaly index is defined as {(number of members whose anomaly is higher than 0.5×SD) – (number of members whose anomaly is lower than – 0.5×SD)}/{number of members} at each grid point, where SD is defined as observed climatological standard deviation.

(b) GPV

Contents		Level(hPa)	Area	Initial Time and Forecast Period
Ensemble mean value of forecast members averaged for 7-days forecast period	Sea level pressure, rainfall amount	---	Global, 2.5°×2.5° (144×73)	Initial time : 12UTC on Wednesday and Thursday for each week Forecast period : day 2–8, day 9–15, day 16–22, day 23–29 from later initial time
	Temperature, Relative Humidity, Wind (u, v)	850		
	Geopotential height	500,100		
	Wind (u, v)	200		
	Sea level pressure anomaly	---	Northern Hemisphere ,2.5°×2.5° (144×37)	
	Temperature anomaly	850		
	Geopotential height anomaly	500,100		

Spread (Standard deviation) among time averaged ensemble member forecasts	Sea level pressure	---		Forecast period : day 2–8, day 9–15, day 16–22, day 23–29, day 2–15, day 16–29, and day 2–29 from later initial time
	Temperature	850		
	Geopotential height	500		
Large anomaly index	Geopotential height	500		

Table A.2 Contents of one-month ensemble prediction verification products at TCC Web site

(a) Score

	Forecast period	Parameter	Verification areas
Anomaly correlation and root mean square error	Day 2–8, day 9–15, day 16–29, day 2–29	Geopotential height at 500hPa,temperature at 850hPa,sea level pressure	Northern Hemisphere (from 20N to 90N), Eurasia (from 20N to 90N and from 0E to 180E), North Pacific (from 20N to 90N and from 90E to 90W), East Asia (from 20N to 60N and from 100E to 179E)
		Stream function at 200hPa and 850hPa, velocity potential at 200hPa and 850hPa, and geopotential height at 500hPa	Global, Tropics (from 20N to 20S), Northern Hemisphere (from 20N to 90N), Southern hemisphere (from 20S to 90S)

(b) Map

	Forecast period	Parameter
Forecast, corresponding objective analysis, and error maps	Day 2–8, day 9–15, day 16–29, day 2–29	Geopotential height and anomaly at 500hPa,temperature and anomaly at 850hPa,sea level pressure and anomaly, stream function and anomaly at 200hPa and 850hPa, velocity potential and anomaly at 200hPa and 850hPa, precipitation (forecast only)
Mean error map for each season		Geopotential height at 500hPa,temperature at 850hPa,sea level pressure

Table A.3. Contents of dynamic prediction products at KMA Web site (http://www.kma.go.kr)

	One-month forecast	Seasonal forecast
Frequency	3 times a month	4 times a year
Date of update	8th/18th/28th day of each month	Late in Feb./May/Aug./Nov.
Forecast range	1-month, 1-10day, 11-20day, 21-30day	3-month, 1st/2nd/3rd month
Products	850hPa temperature, 500 and 200hPa geopotential height, Sea-level pressure, Precipitation	
Format	Ensemble mean, anomaly, eddy anomaly	

Table A.4. Contents of prediction products at APCN Web site (http://www.apcn21.net)

	Experimental seasonal forecast
Frequency	2 times a year (expect 4 times from 2005)
Date of update	Early May/ Nov.
Forecast range	3-month, 1st/2nd/3rd month
Products	850hPa temperature, 500hPa geopotential height, Precipitation
Format	Mean, anomaly for each Single model and Ensemble result