

Final Report
on
The Project for Development of Human Capacity
for
Weather Forecasting and Data Analysis
in
Mongolia

October 2008

JAPAN INTERNATIONAL COOPERATION AGENCY
JAPAN WEATHER ASSOCIATION

環境

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Table of Contents

List of Abbreviations

1. PROJECT OUTPUTS	1
1.1 Achievement of Outputs	1
1.2 List of Outputs.....	7
2. ACTUAL IMPLEMENTATION SCHEDULE OF ACTIVITY	8
3. ACTUAL INPUTS	10
3.1. Dispatch of Short-term JICA Expert Team.....	10
3.2. Counterpart Training in Japan.....	12
3.3. Provision of Equipment	13
3.4. Operational Expense in Mongolia.....	16
4. ISSUES, IDEAS AND LESSONS LEARNED ON PROJECT IMPLEMENTATION.....	17
5. REVISION OF PDM.....	19
6. THE SUBJECT DETERMINED IN THE JCC.....	32

Annexes

1. Pictures in activities in each field
2. Outputs (in separate volumes)

List of Abbreviations

ADB	: Asian Development Bank
CCM	: Community Climate Model
CMA	: China Meteorological Administration
C/P	: Counterpart
DB	: Database
DDEWS	: Drought/Dzud Early Warning System
DSS	: Dust Storms/yellow Sand
ECMWF	: European Centre for Medium-Range Weather Forecasts
FY	: Fiscal Year
GCM	: General Circulation Model
GEF	: Global Environment Facility
GIS	: Geographical Information System
GPS	: Global Positioning System
GPV	: Grid Point Value
GTS	: Global Telecommunication System
ICC	: Information and Computer Center
IMH	: Institute of Meteorology and Hydrology
JCC	: Joint Coordinating Committee
JFY	: Japanese Fiscal Year
JICA	: Japan International Cooperation Agency
JMA	: Japan Meteorological Agency
KMA	: Korea Meteorological Administration
M/M	: Minutes of Meetings
MM5	: Fifth-Generation NCAR / Penn State Mesoscale Model
M/P	: Master Plan
MRI/JMA	: Meteorological Research Institute / Japan Meteorological Agency
NADM	: National Agency for Disaster Management
NAMHEM	: National Agency for Meteorology, Hydrology and Environment Monitoring of Mongolia
NCAR	: The National Center for Atmospheric Research
NCEP	: National Center for Environment Prediction
NWP	: Numerical Weather Prediction
OJT	: On the Job Training
PCM	: Project Cycle Management
PDM	: Project Design Matrix
PO	: Plan of Operation
R/D	: Record of Discussions
RegCM3	: Regional Climate Model Version 3
WG	: Working Group
WMO	: World Meteorological Organization

1. PROJECT OUTPUTS

1.1 Achievement of Outputs

The progress of the project achievements at the end of the Project is indicated in the following table.

Progress of the Project Achievements				
Project Purpose	Objectively Verifiable Indicators	Achievements	Reason of Insufficiency Achievement	
More reliable, useful and timely weather information including dust storms and yellow sand (DSS) data is provided through developing the capacity of the weather service staff and related environmental experts.	a. Weather forecasts using regional numerical weather prediction and new weather analysis methods are provided twice a day for Short-term/once a day for Middle-term/once a month for Long-term.	Weather forecasts using regional numerical weather prediction and new weather analysis methods are provided twice a day for Short-term/once a day for Middle-term/twice a year for Long-term are provided.		
	b. Information on climate change projection over Mongolia is publicized once before the end of the project period.	Information on climate change projection over Mongolia was publicized before the end of October 2008.		
	c. Information on drought/dzud is provided annually (at the end of August).	A pasture capacity map on the bag scale and its summary are published through newspapers etc. Remotely sensed vegetation index and ground-surveyed biomass maps are published through the web site.		
	d. DSS monitoring data is provided for 300 days in a year.	Between January-July 2008 (212 days), 9 days missed=95% data acquisition rate 95% > 300 days/year=83% The objective was achieved.		
	e. Satisfaction level of users (public administrators, nomads, etc.) on the available weather forecast information is improved.	Satisfaction level of users, who attended to the workshops, on utilization of weather information was improved.		
Outputs	Indicators	Achievements	Reason of Insufficiency Achievement	
1. Operational numerical weather prediction using a regional model around Mongolia is implemented.	1.1. Regional numerical weather prediction system originated by NAMHEM is commenced in the daily operation	Regional numerical weather prediction system (5-day forecast) applied with the boundary condition of JMA Global model was commenced in the daily operation		
	1.2. Four (4) staff are capable of operational numerical weather prediction (NWP)	Three (3) staff were developed.		
	Activities	Achievement Ratio	Achievements	Reason of Insufficiency Achievement
	1.1. To conduct training/seminars on numerical weather prediction (NWP)	100%	Trainings/seminars on numerical weather prediction were conducted in Mongolia. Training in Japan was conducted.	
	1.2. To establish operational 5 to 7-day NWP system	100%	Five-day forecast using the boundary condition of JMA global model is daily implemented.	

	and assess its result in comparison with the existing operational forecast		Comparison between 5-day forecast and the existing forecast was implemented.	
	1.3. To procure and set up equipment for training on numerical weather prediction	100%	All the planned equipment were procured and installed.	
Outputs	Indicators		Achievements	Reason of Insufficiency Achievement
2. Climate change projection due to global warming using a climate model is implemented.	2.1. Information on climate change due to global warming over Mongolia is publicized		Information on climate change due to global warming was publicized before the end of October 2008.	
	2.2. Two (2) staff are capable of climate change projection		One (1) staff was developed.	
	Activities	Achievement Ratio	Achievements	Reason of Insufficiency Achievement
	2.1. To conduct training on climate change projection using a climate model	100%	• Training on climate change projection using a climate model was conducted. • Training in Japan was conducted.	
	2.2. To implement climate change projection such as surface temperature, humidity, precipitation, snowfall and wind	90%	Climate change projection was implemented at the end of October 2008.	
	2.3. To procure and set up equipment for climate change projection	100%	All the planned equipment were procured and installed.	
Outputs	Indicators		Achievements	Reason of Insufficiency Achievement
3. Short/ middle/ long-term weather forecasts based on NWP outputs are issued.	3.1. Short/middle-term forecasts for scale smaller than province (aimag) is implemented		Short/middle-term forecasts for scale smaller than aimag were implemented.	
	3.2. Long-term forecast for scale similar to the province (aimag) is implemented		Long-term forecast of aimag scale, especially seasonal forecast, was introduced using JMA ensemble forecast data.	
	3.3. Five (5) staff are capable of advanced weather analysis using data from NWP models		Three (3) staff were developed.	One C/P was retired and another C/P is in long leave.
	Activities	Achievement Ratio	Achievements	Reason of Insufficiency Achievement
	3.1. To conduct training on interpretation of NWP outputs including ensemble forecasting technique	100%	Training on interpretation of NWP outputs including ensemble forecasting technique was conducted.	
	3.2. To develop operational guidance for forecasting	100%	New guidance method on daily max/min surface air temperature at each station was introduced to operational forecast on the basis of ECMWF global model outputs	

	3.3. To develop a computer-aided case study handbook on typical and unusual phenomena	100%	A computer-aided case study handbook on typical and unusual phenomena was made.		
	3.4. To develop new concepts of forecast such as precipitation probability forecast	100%	Long-term forecast, especially seasonal forecast, was introduced using ensemble mean outputs from JMA long-term ensemble forecast.		
	3.5. To conduct training on very short-range forecast using weather radar data	100%	Trainings on basic knowledge of the Doppler radar system and utilization of short-range rainfall prediction for weather forecasting were conducted.		
	3.6. To procure and set up equipment for operational forecasting work	100%	All the planned equipment were procured and installed.	In JCC held in March 2008, no procurement of an electronic panel for weather briefing was decided.	
Outputs	Indicators		Achievements	Reason of Insufficiency Achievement	
4. Drought/dzud early warning system (DDEWS) is established.	4.1. Maps of pasture biomass and plant height on the village (bag) scale are developed		A pasture biomass map in a finer spatial resolution (bag scale) was developed. A wintertime plant height map in a finer spatial resolution (bag scale) was developed.		
	4.2. Guideline of warning and advisory messages is implemented in the operation		Guidelines of drought/dzud were prepared.	Guidelines of drought/dzud prepared in the Project is not operationally used since issuance conditions of dzud warning in under discussions in the Government of Mongolia..	
	4.3. Four (4) staff are capable of early warning using GIS data		The following personnel were developed. · Ms. B. Erdenetsetseg · Mr. R. Gankhuu · Ms. M. Erdenetuya · Ms. M. Bayasgalan · Ms. B. Gantsetseg		
	Activities	Achievement Ratio	Achievements	Reason of Insufficiency Achievement	
4.1. To conduct training on conceptual framework of a combined drought/dzud early warning system (DDEWS)	4.1. To conduct training on conceptual framework of a combined drought/dzud early warning system (DDEWS)		100%	Seminars were conducted in Mongolia and Japan.	
	4.2. To conduct training of database and GIS technique in the framework of the DDEWS		100%	Seminars and practices were conducted in Mongolia.	
	4.3. To revise the present zoo-meteorological observation programme and manual		100%	The program and the manual were revised with special focus in rearranging observed items and in clarifying the text phrases.	

			Seminars using the revised manual were held.	
	4.4. To produce guidelines of warning and advisory messages	100%	Guidelines of drought/dzud were designed.	
	4.5. To produce pasture condition maps on the village (bag) scale	100%	A pasture capacity map combining biomass, pasture area and livestock numbers on the bag scale was developed.	
	4.6. To procure and set up equipment for agro/zoo-meteorology and GIS	100%	All the planned equipment were procured and installed.	
Outputs	Indicators		Achievements	Reason of Insufficiency Achievement
5. Knowledge and understandings about weather and climate information in central/local governments, related organizations/agencies and end-users including nomads and general public in Mongolia are deepened.	5. Six Hundred and Forty (640) users are receiving explanation on use of weather information		943 people participated in the workshops on utilization of weather information. The number of leaflet distributed in all aimags in Mongolia: 14,000	
	Activities	Achievement Ratio	Achievements	Reason of Insufficiency Achievement
	5.1. To conduct seminars in Ulaanbaatar both for the project launching and wrapping-up	100%	Seminars at the middle term of the Project were conducted in June 2008 as well as project launching and wrapping-up seminars.	
	5.2. To conduct workshops targeted to government organizations/agencies	100%	6 workshop held The number of participants: 236	
	5.3. To conduct seminars/workshops in pilot aimags (Hentii, Dondogobi, GobiAltai) on use of weather information targeted to local government (aimag/soum) and end users including herders and general public	100%	3 aimags x 5 times each = 15 times in total The number of participants: 707	
	5.4. To procure and set up equipment for seminars/workshops	100%	All the planned equipment were procured and installed.	
	5.5. To conduct surveys to assess the needs of weather information and level of understandings for end-users (public administrators, nomads, etc.)	100%	Opinion exchange and questionnaire surveys were implemented in the workshops.	
	5.6. To analyze the survey results and provide feedback to the related project activities	100%	The results of questionnaire surveys were shared among Japanese/Mongolian experts.	

Outputs	Indicators		Achievements	Reason of Insufficiency Achievement
6. Weather observation and forecasting systems especially weather radar and computer network are stably operated.	6.1. Appropriate operating rates of weather radar are maintained		Secured radar system operation rate: 99.7% Regular maintenance with the check sheets was included in the routing work. Efficiency of the maintenance work improved due to familiarization with the measuring instrument operation. The engineers' stance for system operation and maintenance was positively expanded.	
	6.2. Three (3) staff are capable of maintenance of radar		Five (5) staff were developed.	
	6.3. System problems of computer networks in NAMHEM are properly managed		NAMHEM Head Office and aimag Centers become easy to connect the Internet. The existing access limitation among the International Airport, the Radar Station and NAMHEM Head Office was released.	
	6.4. More than two (2) staff are capable of maintenance of computer networks		Five (5) staff were developed.	
		Activities	Achievement Ratio	Achievements
	6.1. To produce operation and maintenance manual of weather radar system	100%	Daily, weekly, monthly, biannual and annual maintenance check sheets of the Excel file were prepared. Check sheets with pictures of; 1) measuring instrument connection procedures, 2) unit replacement procedures, and, 3) appropriate wave form displayed by the instrument, were prepared.	
	6.2. To conduct training on operation and maintenance of weather radar system	100%	Technique transfer on principle operation and trouble shooting was implemented. Training on procurement and management of the spare parts of the equipment was implemented. Training on operation of the measurement instrument was implemented. Training on utilization of the check sheets was implemented.	
	6.3. To make overall plan of computer network in NAMHEM	100%	Solution plan for the existing network was prepared.	
	6.4. To conduct training on	100%	Trainings on solving problem solution with equipment newly	

Outputs	Indicators	Achievements	Reason of Insufficiency Achievement	
7. Information on monitoring of DSS issued.	7.1. Analyzed DSS monitoring information is developed	procured were implemented. DSS information is unloaded onto the www server set at NAMHEM.		
	7.2. Four (4) staff are capable of DSS monitoring	The following personnel were developed. · Mr. D. Batdorj (NAMHEM) · Ms. J. Shulentuya (Sainshand) · Mr. Kh. Enkhbayar (Zamin-uud) · Mr. D. Otogonbayar (Dalanzadgad)		
	Activities	Achievement Ratio	Achievements	Reason of Insufficiency Achievement
	7.1. To procure and set up DSS monitoring system	100%	According to the schedule, equipment installation at the 4 sites was completed.	
	7.2. To conduct training on operation and maintenance of DSS monitoring network and data analysis	100%	The engineers from the 4 DSS monitoring sites were trained in Ulaanbaatar.	

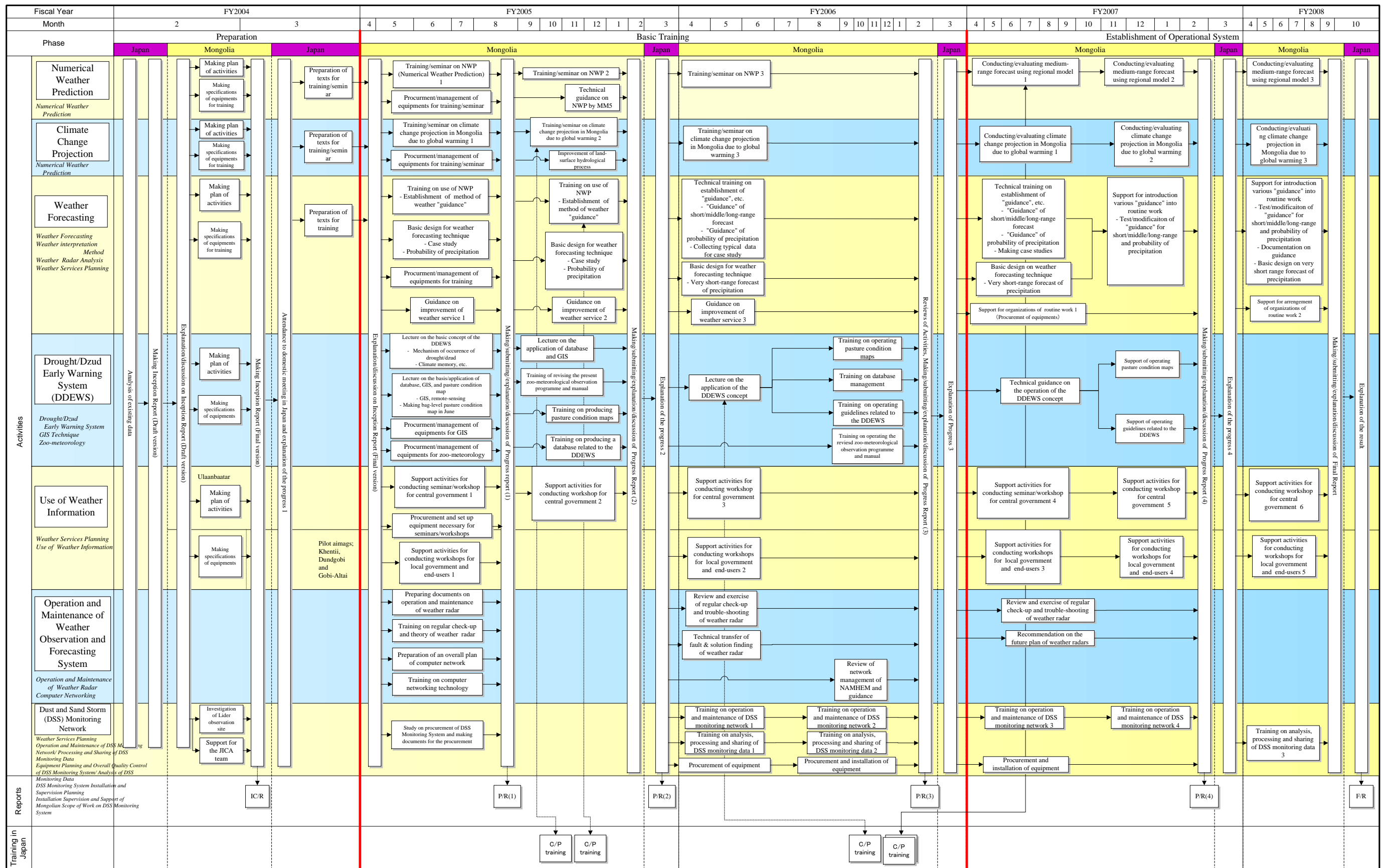
1.2 List of Outputs

The outputs of the Project are listed in the following table.

Field	Output
Numerical Weather Prediction	Middle-term forecast (provided once a day)
Climate Change Projection	Information on climate change due to global warming over Mongolia (surface air temperature, precipitation, snowfall, humidity and wind)
Weather Forecasting	Short-term forecast (provided twice a day)
	Long-term forecast (provided twice a year)
	Computer-aided case study handbook on typical and unusual phenomena
Weather Interpretation Method	Suggestion for the Precipitation Guidance using Product of RSM of mean rainfall amount
Weather Radar Analysis	Utilization of Doppler radar for weather observation
Drought/Dzud Early Warning System GIS Technique Zoo-meteorology	Information on drought/dzud provided annually (at the end of August)
	Maps of pasture biomass on the village (bag) scale, outline
	Information on drought/dzud provided on the web (Vegetation map, Biomass map, Drought map and Snow map)
	Maps of plant height on the village (bag) scale
	Guideline of warning and advisory messages
	Revised zoo-meteorological observation program
	Revised zoo-meteorological observation manual
Use of Weather Information	Participants list of workshops
	Results of questionnaire survey
	Leaflet on practical use of weather information
Operation and Maintenance of Weather Radar System	Operation and maintenance manual of weather radar system
	AVR and UPS Check Sheet (Weekly)
Computer Networking	Overall plan of computer network in NAMHEM
	The problems and the future expansion plan of the NAMHEM network
Dust and Sand Storm (DSS) Monitoring Network	Equipment for Kosa Monitoring Network
	DSS monitoring data

2. ACTUAL IMPLEMENTATION SCHEDULE OF ACTIVITY

The actual implementation schedule of the Project during 5 years is as the Flow Chart at the next page.



Italic type = Japanese expert

FLOWCHART (Project)

3. ACTUAL INPUTS

3.1 Dispatch of Short-term JICA Expert Team

The following 15 JICA short-term experts have involved the Project for five years (total M/M of 75.87) in accordance with the schedule attached hereunder.

- 1) Leader/ Numerical Weather Prediction/Climate Change projection
- 2) Deputy Leader/ Weather Services Planning
- 3) Weather Forecasting
- 4) Weather Interpretation Method
- 5) Weather Radar Analysis
- 6) Drought/Dzud Early Warning System (DDEWS)
- 7) GIS Technique
- 8) Zoo-meteorology
- 9) Use of Weather Information
- 10) Operation and Maintenance of Weather Radar System
- 11) Computer Networking
- 12) Operation and Maintenance of DSS Monitoring Network/ Processing and Sharing of DSS Monitoring Data
- 13) Equipment Planning and Overall Quality Control of DSS Monitoring System/ Analysis of DSS Monitoring Data
- 14) DSS Monitoring System Installation and Supervision Planning
- 15) Installation Supervision and Support of Mongolian Scope of Work on DSS Monitoring System

No.	Field	Name	Phase	1st FY			2nd FY						3rd FY						4th FY						5th FY														
				FY	FY2004			FY2005						FY2006						FY2007						FY2008													
					Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
				Preparation			Basic Training												Establishment of Operational																				
1	Leader/ Numerical Weather Prediction	Dr. Yasuo SATO (Mr.)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
2	Deputy Leader/ Weather Services Planning	Mr. Yoshihisa UCHIDA		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3	Weather Forecasting	Dr. Takehiko FURUKAWA (Mr.)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
4	Weather Interpretation Method	Ms. Ritsuko SASAKI							■													■																	
5	Weather Radar Analysis	Mr. Hideshige IIDA				■											■																				■		
6	Drought/Dzud Early Warning System	Dr. Masato SHINODA (Mr.)		■			■								■																								
7	GIS Technique	Dr. Kaoru TACHIIRI (Mr.)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
8	Zoo-meteorology	Dr. Yuki MORINAGA (Ms. Yuki SHINODA)						■								■																							
9	Use of Weather Information	Mr. Soshi IWATA		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
10	Operation and Maintenance of Weather Radar System	Mr. Takehiro YOSHIDA				■										■							■																
11	Computer Networking	Mr. Shinya SHIMODA				■										■																							
12	Operation and Maintenance of DSS Monitoring Network/ Processing and Sharing of DSS Monitoring Data	Dr. Ichiro MATSUI (Mr.)																					■	■		■	■		■	■		■	■						
13	Equipment Planning and Overall Quality Control of DSS Monitoring System/ Analysis of DSS Monitoring Data	Dr. Nobuo SUGIMOTO (Mr.)																																			■		
14	DSS Monitoring System Installation and Supervision Planning	Mr. Yoshihisa UCHIDA																					■	■		■	■												
15	Installation Supervision and Support of Mongolian Scope of Work on DSS Monitoring System	Mr. Toshihide ENDO																						■	■		■	■											

XX = XX days

3.2 Counterpart Training in Japan

The C/P Trainings conducted in Japan in 2nd FY and 3rd FY are indicated in the following table.

Curriculum	Major contents	Period	Name of Trainee
2nd FY			
Climate Change projection technique using the regional climate model due to global warming (Field of the Climate Change Projection)	To assess model performances of the Mongolian regional climate model to represent Mongolian climate by comparing results of the Mongolian model with the results of an MRI model and two observation data using MRI/JMA super-computer system.	25 November, 2005 to 2 December, 2005	Mr. P. Gomboluudev (C/P of field of Numerical Weather Prediction/ Climate Change Projection)
Weather forecasting using numerical weather prediction outputs (Field of Numerical Weather Prediction/ Weather Forecasting)	Lecture on operational forecasting in Japan Meteorological Agency, local weather observatory and private weather provider etc.	29 November, 2005 to 9 December, 2005	Ms. L. Oyunjargal Mr. G. Bayasgalan Ms. B. Tsatsral Mr. B. Buyantogtokh (Numerical Weather Prediction/ Guidance Working Grope)
3rd FY			
Data assimilation technique on regional meso-scale short-term forecast models (Field of Numerical Weather Prediction)	To learn theoretical background of advanced data assimilation technique (3D-VAR) and to obtain practical training on one of the MRI workstations using surface observation or satellite data in a regional meso-scale short-range forecast model similar to the Mongolian regional short-range forecast model (MM5).	15 January, 2007 to 1 February, 2007	Mr. A. Batbold (C/P of field of Numerical Weather Prediction/ Climate Change Projection)
Japan's Weather forecasting activities from numerical weather prediction outputs	Lecture on operational forecasting in Japan Meteorological Agency, local weather observatory and private weather provider etc.	15 January, 2007 to 19 January, 2007	Mr. J. Tsogt (C/P of field of Use of Weather Information)
Drought/Dzud Early Warning System	Lectures and seminar on livestock ecology and agricultural meteorology at JICA Tokyo International Center and Arid Land Research Center of Tottori University.	9 January, 2007 to 19 January, 2007	Ms. M. Bayasgalan Ms. M. Erdenetuya Ms. B. Erdenetsetseg Ms. B. Gantsetseg (C/P of the field of Drought/Dzud Early Warning System)

3.3 Provision of Equipment

The equipment provided to NAMHEM under the Project is listed in the following table.

Name of Equipment	Model Name, Specifications	Q'ty
1st FY		
GPS	Handy type	25
Dry Cell for GPS	AAA Cell Battery	8
GPS	Handy type	5
Electric scales	NJW-300	30
Weighing Instruments	RP-500	2
Weighing Instruments	RP-100	8
Standard weight 5kg		80
Standard weight 20kg		16
Desktop PC	DELL17" Optiplex GX170L	14
LCD Monitor	DELL17" LCD	18
CD-RW	700 MB	1400
MS-Windows XP	Professional	14
MS-Office 2003	Professional	15
Linux OS	Freeware	10
Net CDF	Freeware	10
NCARG	Freeware	10
UPS	MGE Premium	18
Inkjet Printer	Canon i6100	2
Inkjet for Canon i6100	BCI-3E	16
Switch	D-Link	3
Cable	UTP	500m
Connector	RJ-45	30
Power Extension Cable	MGE Pulsar 5	10
PC Workstation	DELL Precision 380 N	2
Server	DELL PowerEdge 800	2
Linux OS	Red Hat Enterprise	4
Tape Cartridge	20/40GB DDS4	40
Fortran Software	PGI(1user)	2
Fortran Software	PGI(10 user)	1
GIS Software	ArcGIS9.1(with ArcView + Spatial Analyst)	2
Remote Sensing Soft	Imagine 8.7	2
Projector	HP VP6121	1
Projector Case	Carrying	1
Projector Lump	Lamp Unit	3
Laser Pointer		1
Note PC	DELL Latitude D510	1
USB Memory	256MB	1
Mouse	Optical	1
Color Copy Machine	Canon iRC3100	1
Printer Unit for Color Copy Machine	Canon E1	1
Toner for Color Copy Machine	Cyan, Magenta, Yellow, Black	20
Copy Paper for Color Copy Machine	White, 500 sheets	10
Books	James R. Holton, "An Introduction to Dynamic Meteorology/ Fourth Edition"	5
Books	Eugenia Kalnay, "Atmospheric Modeling Data Assimilation and Predictability"	5
Books	Shunlin Liang, "Quantitative Remote Sensing of Land Surfaces"	5
Books	Peter A. Burrough and Rachael A.M.Donnell, "Principles of Geographical Information System"	5
Books	Craig Hunt, "TCP/IP Network Administration"	3
Book	Philip Miller, "TCP/IP Explained"	1

2nd FY		
Drying Instrument		5
Book	Bill Kropla, "MapServer: Open Source GIS Development"	1
Book	Schuyler Erle, "Mapping Hacks"	1
Book	Tyler Mitchell, "Web Mapping Illustrated"	1
Book	Neil Matthews, "Beginning Databases With PostgreSQL: From Novice To Professional, Second Edition"	1
3rd FY		
Broadband Gateway	D-Link DI-808HV	4
Router	Cisco CISCO1811/K9	2
Switch	D-Link DES1008D	4
Desktop PC with Monitor	DELL Optiplex Gx210L	2
UPS	APC 1500VA	1
Switch	D-Link DES1008D	2
GIS Extension 1	ESRI ArcGIS 3D Analyst	2
GIS Extension 2	ESRI ArcGIS Geostatistical Analyst	2
Ground-based Kosa Monitoring System	TOADKK DUB-222(S)	1
Data Collection and Analyzing System	TOADKK DNS-309(S)	1
Data Display and Publication System	TOADKK DNS-101W(S)	1
Data Publication System	TOADKK DNS-101W(S2)	1
Firewall	Cisco Cisco1712	1
Modem	OMRON OMRON5614	1
Ethernet Switch	Allied Telesis FS716TXL	2
Book	Bluestein, H., 1993: Synoptic-Dynamic Meteorology in Midlatitudes, Observations and Theory of Weather System, Vol.II, Oxford University Press, New York.	1
Books	Houze, R.A., Jr., 1993 "Cloud Dynamics", Academic Press, San Diego. 2 volumes .	2
4th FY		
Lidar Aerosols Monitoring System	Sibata L 2S-SM II (cold resistance type)	1
Ground-based Kosa Monitoring System	TOADKK DUB-222(S)	1
Container-type Shed for Aerosols Monitoring System	Sibata	1
Firewall	Cisco Cisco1712	1
Modem	OMRON OMRON5614	1
Ethernet Switch	Allied Telesis FS716TXL	1
Turn Buckle Support for Container	Sibata FR-2.25-TB	1
Iron Square Frame Support for Container Top Panel	Sibata FR-2.25-SS	1
Consumable parts and Tool for Using at Container Shed Installations	Sibata	1
Installation Materials for Lidar	Sibata	1
Lidar Aerosols Monitoring System	Sibata L 2S-SM II (cold resistance type)	2
Ground-based Kosa Monitoring System	TOADKK DUB-222(S)	2
Auxiliary Power Unit	TOADKK DAP-19(S)	1
Container-type Shed for Aerosols Monitoring System	Sibata FR-2.25S	1
Data Collection and Transfer System	TOADKK DNS-309(S2)	1
Firewall	Cisco Cisco1712	2
Modem	OMRON OMRON5614	2
Ethernet Switch	Allied Telesis FS716TXL	2
Turn Buckle Support for Container	Sibata FR-2.25-TB	1
Iron Square Frame Support for Container Top Panel	Sibata FR-2.25-SS	1
Observation Window with Assembly	Sibata FR-WS	1
Digital Oscilloscope	Sibata DPO4034	1

Band Pass Filter 532µm for Lidar	Sibata	6
Band Pass Filter 1064µm for Lidar	Sibata	3
De Ionization Cartridge Filter for Lidar	Sibata	3
Flash Lamp for Lidar	Sibata	6
In-Line Filter for Lidar	Sibata	3
Circulation Pump for Lidar	Sibata MEC281	3
Power Supply Unit with Leaser head for Lidar	Sibata	1
Spare Parts Unit for TSP & PM10 Monitor	TOADKK	2
Isolation Transformer	TOADKK DUB-223 (S)	4
UPS	TOADKK DNS-33A(S)	1
Hard Disc Unit	500GB	4
Books	Bluestein, H., 1993: Synoptic-Dynamic Meteorology in Midlatitudes, Principles of Kinematics and Dynamics, Vol.I, Oxford University Press, New York.	2

3.4 Operational Expense in Mongolia

The local operational expense in Mongolia generated in the Project is listed in the following table.

	1st FY (Part 1)	1st FY (Part 2)	2nd FY	3rd FY	4th FY	5th FY (Plan)
Local employment	228,022	261,178	2,525,029	1,278,718	2,141,038	650,433
Consumables	2,418	32,880	239,898	111,888	42,181	142,722
Expenditure for the Workshops	-	-	377,887	330,389	672,493	934,636
Inland Transportation for Experts and C/P	64,211	3,010	56,380	51,698	67,707	99,216
Documents/materials Preparation	632	397,582	768,806	5,568	474,676	298,060
Rent-a-Car	212,895	247,749	1,603,460	1,023,429	2,367,563	1,283,602
Communication	-	-	536,750	-	-	-
GIS Data	-	-	184,200	-	-	-

(Unit: Japanese Yen)

4. ISSUES, IDEAS AND LESSONS LEARNED ON PROJECT IMPLEMENTATION

Field	Issues for the Project Implementation	Ideas of Solution for the issues	Recommendation to NAMHEM
Numerical Weather Prediction	None.	None.	None.
Climate Change Projection	None.	None.	None.
Weather Forecasting	We obtained JMA ensemble forecast outputs to use meteorological elements at 850 hPa. However, the south-western part of Mongolia is covered by high mountains, therefore the 850 hPa level is under the mountains.	700 hPa data of JMA climate data server was used alternatively.	None.
Weather interpretation Method	Guidance team had not prepared long-term analysis data.	Guidance team used past 1 year data archived by NWP team.	None.
Weather Radar Analysis	None.	None.	None.
Drought/Dzud Early Warning System	C/Ps' English skills were insufficient.	Japanese↔Mongolian↔English interpreters were used C/Ps learning English was encouraged.	Training of English.
GIS Technique	GPS data collection was delayed due to the lack of fuel charge.	· Observation plans were rearranged to reduce the fuel required. · Horses were used	Securing enough fund for fuels to be used for the observation.
	Data for some observation points far from the soum centers were replaced with those of easily-accessible points.		
	Motivation of the local staff for obtaining accurate data was low.	The local staff's skills in data handling were improved since seminars were conducted.	Continuous education for the local staff by seminars is important.
	There were some inconsistencies in bag names/borders between maps/organizations.	Bag names/borders were confronted using GPS data and observation note as much as possible.	Development of an official map using consented bag names and borders must be implemented.
Zoo-meteorology	Insufficient understanding on contents of the revised manual by the people concerned to zoo-meteorology was available.	Seminars for the people concerned to zoo-meteorology were held.	Seminars for the people concerned to zoo-meteorology to improve their knowledge should be continuously conducted.
Use of Weather Information	Many participants for the workshops in the pilot aimags and Ulaanbaatar were required.	Workshops were conducted in June when nomadic herders are in rest period. Some workshops were conducted in soum (village) as well as in aimag center. Subjects of workshops were selected due questionnaire surveys and exchange of opinions among the participants, NAMHEM and the experts.	Needs of the users must be considered.

	Wider dissemination of the effect produced by the workshops other than the participants of the workshops was required.	14,000 leaflets on utilization of weather information were made and distributed to all aimags of Mongolia. For accelerating the practical use of the leaflets, glossary of weather forecast and protection technique against lightning, etc. were selected. Graphics-rich leaflets were made for easy understanding	The required budget for dissemination of weather information must be secured.
	Capacity building on presentation of the staff of NAMHEM aimag centers was required.	Opportunities for presentation were provided to the staff of NAMHEM aimag centers. Preparation for presentation by the staff of NAMHEM aimag centers were supported by the experts	Periodical opportunities for presentation to the staff of NAMHEM aimag center must be made.
	Frequency of vehicle failures and punctures were occurred during the long-distance movements.	2 vehicles were used for any long-distance movements for safety.	None.
Operation and Maintenance of Weather Radar System	Some differences between checked points and check sheets were found	The check sheets were revised to be suitable for the routine works.	None.
Computer Networking	The existing modem and the router were obsolete.	Advising for update implementation was made.	The required budget for updating equipment every several years should be secured.
Operation and Maintenance of DSS Monitoring Network/ Processing and Sharing of DSS Monitoring Data	Frequent commercial power stoppages are available.	A power failure alarm was additionally furnished with the equipment	None.
Equipment Planning and Overall Quality Control of DSS Monitoring System/ Analysis of DSS Monitoring Data	Calibration of the PM10 meters using the high-volume sampler was difficult for the dss and normal conditions.	Appropriate calibration periods were defined.	None.
DSS Monitoring System Installation and Supervision Planning	None.	None.	None.
Installation Supervision and Support of Mongolian Scope of Work on DSS Monitoring System	None.	None.	None.

5. REVISION OF PDM

Since the activities of DSS monitoring, etc. were added, PDM set up at the Project inception was not satisfied the existing situation. Therefore the Project Purpose and its Indicators in the PDM had been revised. The summary of the revised points in the PDM are indicated in the following table.

Table: Summary of the revised points in the PDM

	Revised Point	Reasons
Project Purpose	e. Satisfaction level of users (public administrators, nomads, etc.) on the available weather forecast information is improved.	In order to confirm satisfaction level of users (public administrators, nomads, etc.) on the available weather forecast information, the study for trends of satisfaction level of users is required.
	The following indicator items were revised.	
	a. Weather forecasts using regional numerical weather prediction and new weather analysis methods are provided twice a day for Short-term/once a day for Middle-term/once a month for Long-term.	In order to confirm the indicators, the numerical target of the weather information service was required.
	b. Information on climate change projection over Mongolia is publicized once before the end of the project period.	
	c. Information on drought/dzud is provided annually (at the end of August).	
	d. DSS monitoring data is provided for 300 days in a year.	
Output	1.1. Regional numerical weather prediction system originated by NAMHEM is commenced in the daily operation	1.1. "Commencement of operating regional numerical weather prediction system originated by NAMHEM" was revised more concretely.
	1.2. Four (4) staff are capable of operational numerical weather prediction (NWP)	1.2. The numerical target and the quantitative indicator for capacity building were set up.
	2.1. Information on climate change due to global warming over Mongolia is publicized	2.1. "Publication of information on climate change due to global warming <i>over Mongolia</i> " was revised as a more concrete expression.
	2.2. Two (2) staff are capable of climate change projection	2.2. The numerical target and the quantitative indicator for capacity building were set up.
	3.1. Short/middle-term forecasts for scale smaller than province (aimag) is implemented	3.1. and 3.2. were revised more concretely.
	3.2. Long-term forecast for scale similar to the province (aimag) is implemented	
	3.3. Five (5) staff are capable of advanced weather analysis using data from NWP models	3.3. The numerical target and the quantitative indicator for capacity building were set up.
	4.1. Maps of pasture biomass and plant height on the village (bag) scale are developed	4.1. and 4.2. were revised more concretely.
	4.2. Guideline of warning and advisory messages is implemented in the operation	
	4.3. Four (4) staff are capable of early warning using GIS data	4.3. The numeric target and the quantitative indicator for capacity building were set up.
5. Six Hundred and Forty (640) users are receiving explanation on use of weather information	5. The numerical target and the quantitative indicator for capacity building were set up.	
6.1. Appropriate operating rates of weather radar are maintained	The individual indicators of the Weather Radar System and the Weather Forecasting System (computer network) were made.	
6.2. Three (3) staff are capable of maintenance of radar		
6.3. System problems of computer networks in NAMHEM are properly managed	The numerical target and the quantitative indicator for capacity building of 6.2. and 6.4. were set up.	
6.4. More than two (2) staff are capable of maintenance of computer networks		

	7.1. Analyzed DSS monitoring information is developed 7.2. Four (4) staff are capable of DSS monitoring	7.1. was revised more concretely. 7.2. The numerical target and the quantitative indicator for capacity building were set up.
Important Assumption: the following Important Assumptions were added.		
	Activities → Outputs Sufficient budget on equipment maintenance will be allocated to NAMHEM.	Since appropriate maintenance of the equipment supplied under is significant for the Project activities, conditions of the maintenance cost have been added.
	Outputs → Project Purpose Sufficient budgets will be allocated to NAMHEM in a timely manner.	It was expected that maintaining the Project effect might be difficult since aggravation of the financial situation of NAMHEM, “budgets will be allocated” was added in the Important Assumption.

The original PDM, 1st revised PDM (revised parts: red color), and 2nd revised PDM (revised parts: blue color) are attached hereunder.

PDM (Original)

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
<p>Overall Goal Weather information is utilized for natural disaster management and climate change impact assessment in Mongolia.</p>	<p>Work plans of natural disaster management and climate change impact assessment of Mongolia are established and implemented.</p>	<p>Research studies for use of weather information</p>	
<p>Project Purpose To provide more reliable, useful and timely weather information including DSS data through developing the capacity of the weather service staff and related environmental experts</p>	<p>a. Times of provision of short/middle/long-range weather forecasts using regional numerical weather prediction and new weather analysis methods b. Times of provision of information on climate change projection over Mongolia c. Times of provision of information on drought/dzud</p>	<p>a. Final Report of the Project b. Final Report of the Project c. Final Report of the Project</p>	<p>State policy on weather services for natural disaster management and climate change impact assessment remains unchanged.</p>
<p>Outputs</p> <ol style="list-style-type: none"> 1. Operational numerical weather prediction using a regional model around Mongolia is implemented. 2. Climate change projection due to global warming using a climate model is implemented. 3. Short/middle/long-term weather forecasts based on NWP outputs are issued. 4. Drought/dzud early warning system (DDEWS) is established. 5. Knowledge and understandings about weather and climate information in central/local governments, related organizations/agencies and end-users including herders and general public in Mongolia are deepened. 6. Weather observation and forecasting systems especially weather radar and computer network are stably operated. 	<ol style="list-style-type: none"> 1.1. Commencement of operation of regional numerical weather prediction system originated by NAMHEM 1.2. 5 staff capable of operational numerical weather prediction (NWP) 2. Publication of information on climate change due to global warming over Mongolia 3.1. Short/middle-term forecasts for scale smaller than province (aimag) 3.2. Use of an ensemble method for long-term forecast 3.3. 5 staff capable of advanced weather analysis using data from NWP models 4.1. Maps of pasture biomass and plant height on the village (bag) scale 4.2. 4 staff capable of early warning using GIS data 5. Number of persons who receive explanation on use of weather information 6. Operating rates of weather observation and forecasting system (weather radar and computer network) 	<ol style="list-style-type: none"> 1.1. Forecast Operation Room 1.2. Final Report of the Project 2. Bulletin of Institute of Meteorology and Hydrology (IMH) of NAMHEM 3.1. Record files of forecasts 3.2. Forecast Operation Room 3.3. Final Report of the Project 4.1. Agrometeorological and Environmental Bulletin 4.2. Final Report of the Project 5. Final Report of the Project 6. Records of system failure 	

Activities	Inputs	
<p>1.1. To conduct training/seminars on numerical weather prediction (NWP)</p> <p>1.2. To establish operational 5 to 7-day NWP system and assess its result in comparison with the existing operational forecast</p> <p>1.3. To procure and set up equipment for training on numerical weather prediction</p> <p>2.1. To conduct training on climate change projection using a climate model</p> <p>2.2. To implement climate change projection such as surface temperature, humidity, precipitation, snowfall and wind</p> <p>2.3. To procure and set up equipment for climate change projection</p> <p>3.1. To conduct training on interpretation of NWP outputs including ensemble forecasting technique</p> <p>3.2. To develop operational guidance for forecasting</p> <p>3.3. To develop a computer-aided case study handbook on typical and unusual phenomena</p> <p>3.4. To develop new concepts of forecast such as precipitation probability forecast</p> <p>3.5. To conduct training on very short-range forecast using weather radar data</p> <p>3.6. To procure and set up equipment for operational forecasting work</p>	<p>(Japanese Side)</p> <p>1. Dispatch of experts</p> <p><Long-term experts></p> <p>-1 Numerical weather prediction (Leader)</p> <p>-1 Weather forecasting</p> <p><Short-term experts></p> <p>-1 Weather services planning (Deputy leader)</p> <p>-1 Weather interpretation method</p> <p>-1 GIS technique</p> <p>-1 Weather radar analysis</p> <p>-1 Drought/dzud early warning system</p> <p>-1 Zoo-meteorology</p> <p>-1 Use of weather information</p> <p>-1 Operation and maintenance of weather radar</p> <p>-1 Computer networking</p> <p>2. Equipment supply</p> <p>3. Provision of training in Japan</p>	<p>(Mongolian Side)</p> <p>1. Provision of project office and places for equipment to be supplied</p> <p>2. Setting up of working groups</p> <p>3. Allocation of counterpart personnel</p> <p>4. Security of offices or places to be used for the Project</p> <p>5. Provision of financial sources for on-site project management</p> <p>Trained staff continues to work at their positions.</p>

- | | |
|---|--|
| <ul style="list-style-type: none"> 4.1. To conduct training on conceptual framework of a combined drought/dzud early warning system (DDEWS) 4.2. To conduct training of database and GIS technique in the framework of the DDEWS 4.3. To revise the present zoo-meteorological observation programme and manual 4.4. To produce guidelines of warning and advisory messages 4.5. To produce pasture condition maps on the village (bag) scale 4.6. To procure and set up equipment for agro/zoo-meteorology and GIS 5.1. To conduct seminars in Ulaanbaatar both for the project launching and wrapping-up 5.2. To conduct workshops in Ulaanbaatar on use of weather information targeted to government organizations/agencies 5.3. To conduct seminars/workshops in pilot aimags (Hentii, Dondogobi, Gobi-altai) on use of weather information targeted to local government (aimag/soum) and end users including herders and general public 5.4. To procure and set up equipment for seminars/workshops | |
| <ul style="list-style-type: none"> 6.1. To produce operation and maintenance manual of weather radar system 6.2. To conduct training on operation and maintenance of weather radar system 6.3. To make overall plan of computer network in NAMHEM 6.4. To conduct training on computer networking | <p>Pre-conditions
To be able to obtain cooperation of organizations/agencies related to natural disaster management</p> |

Pre-conditions

To be able to obtain cooperation of organizations/agencies related to natural disaster management

PDM (1st Revision)

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
<p>Overall Goal Weather information is utilized for natural disaster management and climate change impact assessment in Mongolia.</p>	<p>Work plans of natural disaster management and climate change impact assessment of Mongolia are established and implemented.</p>	<p>Research studies for use of weather information</p>	
<p>Project Purpose To provide more reliable, useful and timely weather information including DSS data through developing the capacity of the weather service staff and related environmental experts</p>	<p>a. Times of provision of short/middle/long-range weather forecasts using regional numerical weather prediction and new weather analysis methods b. Times of provision of information on climate change projection over Mongolia c. Times of provision of information on drought/dzud</p>	<p>a. Final Report of the Project b. Final Report of the Project c. Final Report of the Project</p>	<p>State policy on weather services for natural disaster management and climate change impact assessment remains unchanged.</p>
<p>Outputs</p> <ol style="list-style-type: none"> 1. Operational numerical weather prediction using a regional model around Mongolia is implemented. 2. Climate change projection due to global warming using a climate model is implemented. 3. Short/middle/long-term weather forecasts based on NWP outputs are issued. 4. Drought/dzud early warning system (DDEWS) is established. 5. Knowledge and understandings about weather and climate information in central/local governments, related organizations/agencies and end-users including herders and general public in Mongolia are deepened. 6. Weather observation and forecasting systems especially weather radar and computer network are stably operated. 7. Information on monitoring of dust storms and yellow sand (DSS) is issued. 	<ol style="list-style-type: none"> 1.1. Commencement of operation of regional numerical weather prediction system originated by NAMHEM 1.2. 5 staff capable of operational numerical weather prediction (NWP) 2. Publication of information on climate change due to global warming over Mongolia 3.1. Short/middle-term forecasts for scale smaller than province (aimag) 3.2. Use of an ensemble method for long-term forecast 3.3. 5 staff capable of advanced weather analysis using data from NWP models 4.1. Maps of pasture biomass and plant height on the village (bag) scale 4.2. 4 staff capable of early warning using GIS data 5. Number of persons who receive explanation on use of weather information 6. Operating rates of weather observation and forecasting system (weather radar and computer network) 7. Analyzed DSS monitoring information 	<ol style="list-style-type: none"> 1.1. Forecast Operation Room 1.2. Final Report of the Project 2. Bulletin of Institute of Meteorology and Hydrology (IMH) of NAMHEM 3.1. Record files of forecasts 3.2. Forecast Operation Room 3.3. Final Report of the Project 4.1. Agrometeorological and Environmental Bulletin 4.2. Final Report of the Project 5. Final Report of the Project 6. Records of system failure 7. Central Monitoring System in Ulaanbaatar 	

Activities	Inputs	
1.1. To conduct training/seminars on numerical weather prediction (NWP)	(Japanese Side) 1. Dispatch of experts	(Mongolian Side) 1. Provision of project office and places for their positions.
1.2. To establish operational 5 to 7-day NWP system and assess its result in comparison with the existing operational forecast	<Long-term experts> -1 Numerical weather prediction (Leader) -1 Weather forecasting	1. Provision of project office and places for equipment to be supplied
1.3. To procure and set up equipment for training on numerical weather prediction	<Short-term experts> -1 Weather services planning (Deputy leader) -1 Weather interpretation method	2. Setting up of working groups
2.1. To conduct training on climate change projection using a climate model	-1 GIS technique -1 Weather radar analysis	3. Allocation of counterpart personnel
2.2. To implement climate change projection such as surface temperature, humidity, precipitation, snowfall and wind	-1 Drought/dzud early warning system -1 Zoo-meteorology	4. Security of offices or places to be used for the Project
2.3. To procure and set up equipment for climate change projection	-1 Use of weather information -1 Operation and maintenance of weather radar -1 Computer networking	5. Provision of financial sources for on-site project management
3.1. To conduct training on interpretation of NWP outputs including ensemble forecasting technique	-1 Analysis and processing of DSS data	
3.2. To develop operational guidance for forecasting	-1 Operation and maintenance of DSS monitoring network	
3.3. To develop a computer-aided case study handbook on typical and unusual phenomena	-1 Equipment planning of DSS monitoring system	
3.4. To develop new concepts of forecast such as precipitation probability forecast	2. Equipment supply	
3.5. To conduct training on very short-range forecast using weather radar data	3. Provision of training in Japan	
3.6. To procure and set up equipment for operational forecasting work		

- 4.1. To conduct training on conceptual framework of a combined drought/dzud early warning system (DDEWS)
- 4.2. To conduct training of database and GIS technique in the framework of the DDEWS
- 4.3. To revise the present zoo-meteorological observation programme and manual
- 4.4. To produce guidelines of warning and advisory messages
- 4.5. To produce pasture condition maps on the village (bag) scale
- 4.6. To procure and set up equipment for agro/zoo-meteorology and GIS

- 5.1. To conduct seminars in Ulaanbaatar both for the project launching and wrapping-up
- 5.2. To conduct workshops in Ulaanbaatar on use of weather information targeted to government organizations/agencies
- 5.3. To conduct seminars/workshops in pilot aimags (Hentii, Dondogobi, Gobi-altai) on use of weather information targeted to local government (aimag/soum) and end users including herders and general public
- 5.4. To procure and set up equipment for seminars/workshops

- 6.1. To produce operation and maintenance manual of weather radar system
- 6.2. To conduct training on operation and maintenance of weather radar system
- 6.3. To make overall plan of computer network in NAMHEM
- 6.4. To conduct training on computer networking

- 7.1. To procure and set up DSS monitoring system
- 7.2. To conduct training on operation and maintenance of DSS monitoring network and data analysis

Pre-conditions

To be able to obtain cooperation of organizations/agencies related to natural disaster management

PDM (2nd Revision)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Overall Goal Weather information is utilized for natural disaster management and climate change impact assessment in Mongolia.</p>	<p>Work plans of natural disaster management and climate change impact assessment of Mongolia are established and implemented.</p>	<p>Research studies for use of weather information</p>	
<p>Project Purpose More reliable, useful and timely weather information including dust storms and yellow sand (DSS) data is provided through developing the capacity of the weather service staff and related environmental experts.</p>	<p>a. Weather forecasts using regional numerical weather prediction and new weather analysis methods are provided twice a day for Short-term/once a day for Middle-term/once a month for Long-term. b. Information on climate change projection over Mongolia is publicized once before the end of the project period. c. Information on drought/dzud is provided annually (at the end of August). d. DSS monitoring data is provided for 300 days in a year. e. Satisfaction level of users (public administrators, nomads, etc.) on the available weather forecast information is improved.</p>	<p>a. Final report of the Project b. Final report of the Project c. Final report of the Project d. Final report of the Project *1 e. Surveys and interviews</p>	<p>State policy on weather services for natural disaster management and climate change impact assessment remains unchanged.</p>
<p>Outputs 1. Operational numerical weather prediction using a regional model around Mongolia is implemented. 2. Climate change projection due to global warming using a climate model is implemented. 3. Short/middle/long-term weather forecasts based on NWP outputs are issued.</p>	<p>1.1. Regional numerical weather prediction system originated by NAMHEM is commenced in the daily operation 1.2. Four (4) staff are capable of operational numerical weather prediction (NWP) 2.1. Information on climate change due to global warming over Mongolia is publicized 2.2. Two (2) staff are capable of climate change projection 3.1. Short/middle-term forecasts for scale smaller than province (aimag) is implemented 3.2. Long-term forecast for scale similar to the province (aimag) is implemented 3.3. Five (5) staff are capable of advanced weather analysis using data from NWP models</p>	<p>1.1. Forecast Operation Room 1.2. Final report of the Project 2.1. Bulletin of Institute of Meteorology and Hydrology (IMH) of NAMHEM 2.2. Final report of the Project 3.1. Record files of forecasts 3.2. Forecast Operation Room 3.3. Final report of the Project</p>	<p>Sufficient budgets will be allocated to NAMHEM in a timely manner.</p>

*1: This phrase is not seen on PDM (1st Revision).

<p>4. Drought/dzud early warning system (DDEWS) is established.</p>	<p>4.1. Maps of pasture biomass and plant height on the village (bag) scale are developed 4.2. Guideline of warning and advisory messages is implemented in the operation 4.3. Four (4) staff are capable of early warning using GIS data</p>	<p>4.1. Agrometeorological and environmental Bulletin 4.2. Final report of the Project 4.3. Final report of the Project</p>	
<p>5. Knowledge and understandings about weather and climate information in central/local governments, related organizations/agencies and end-users including nomads and general public in Mongolia are deepened.</p>	<p>5.1. Six Hundred and Forty (640) users are receiving explanation on use of weather information</p>	<p>5.1. Final report of the Project</p>	
<p>6. Weather observation and forecasting systems especially weather radar and computer network are stably operated.</p>	<p>6.1. Appropriate operating rates of weather radar are maintained 6.2. Three (3) staff are capable of maintenance of radar 6.3. System problems of computer networks in NAMHEM are properly managed 6.4. More than two (2) staff are capable of maintenance of computer networks</p>	<p>6.1. Records of system failure 6.2. Final report of the Project 6.3. Records of system failure 6.4. Final report of the Project</p>	
<p>7. Information on monitoring of DSS issued.</p>	<p>7.1. Analyzed DSS monitoring information is developed 7.2. Four (4) staff are capable of DSS monitoring</p>	<p>7.1. Central monitoring system in Ulaanbaatar 7.2. Final report of the Project</p>	

<p>Activities</p> <p><i>OUTPUT 1 - Operational numerical weather prediction using a regional model around Mongolia is implemented.</i></p> <p>1.1. To conduct training/seminars on numerical weather prediction (NWP)</p> <p>1.2. To establish operational 5 to 7-day NWP system and assess its result in comparison with the existing operational forecast</p> <p>1.3. To procure and set up equipment for training on numerical weather prediction</p> <p><i>OUTPUT 2 - Climate change projection due to global warming using a climate model is implemented.</i></p> <p>2.1. To conduct training on climate change projection using a climate model</p> <p>2.2. To implement climate change projection such as surface temperature, humidity, precipitation, snowfall and wind</p> <p>2.3. To procure and set up equipment for climate change projection</p> <p><i>OUTPUT 3 - Short/middle/long-term weather forecasts based on NWP outputs are issued.</i></p> <p>3.1. To conduct training on interpretation of NWP outputs including ensemble forecasting technique</p> <p>3.2. To develop operational guidance for forecasting</p> <p>3.3. To develop a computer-aided case study handbook on typical and unusual phenomena</p> <p>3.4. To develop new concepts of forecast such as precipitation probability forecast</p> <p>3.5. To conduct training on very short-range forecast using weather radar data</p> <p>3.6. To procure and set up equipment for operational forecasting work</p>	<p>Inputs</p> <p>(Japanese Side)</p> <p>1. Dispatch of experts <Long-term experts> Numerical weather prediction (Leader) Weather forecasting <Short-term experts> Weather services planning (Deputy Leader) Weather interpretation method GIS technique Weather radar analysis Drought/dzud early warning system Zoo-meteorology Use of weather information Operation and maintenance of weather radar Computer networking Analysis, processing and sharing of DSS data Operation and maintenance of DSS monitoring network Equipment planning of DSS monitoring system DSS monitoring system installation and supervision planning *2 Installation supervision and support of Mongolian scope of work on DSS monitoring system *3</p> <p>2. Equipment Supply</p> <p>3. Provision of training in Japan</p> <p>(Mongolian Side)</p> <p>1. Provision of project office and places for equipment to be supplied</p> <p>2. Setting up of working groups</p> <p>3. Allocation of counterpart personnel</p> <p>4. Security of offices or places to be used for the Project</p> <p>5. Provision of financial sources for on-site project management</p> <p>*2 *3: These experts were added after mid-term evaluation.</p>	<p>Trained staff continues to work at their positions.</p> <p>Sufficient budget on equipment maintenance will be allocated to NAMHEM.</p>
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OUTPUT 4 - Drought/dzud early warning system (DDEWS) is established.

- 4.1. To conduct training on conceptual framework of a combined drought/dzud early warning system (DDEWS)
- 4.2. To conduct training of database and GIS technique in the framework of the DDEWS
- 4.3. To revise the present zoo-meteorological observation programme and manual
- 4.4. To produce guidelines of warning and advisory messages
- 4.5. To produce pasture condition maps on the village (bag) scale
- 4.6. To procure and set up equipment for agro/zoo-meteorology and GIS

OUTPUT 5 - Knowledge and understandings about weather and climate information in central/local governments, related organizations/agencies and end-users including nomads and general republic in Mongolia are deepened.

- 5.1. To conduct seminars in Ulaanbaatar both for the project launching and wrapping-up
- 5.2. To conduct workshops targeted to government organizations/agencies
- 5.3. To conduct seminars/workshops in pilot aimags (Hentii, Dondogobi, Gobi-altai) on use of weather information targeted to local government (aimag/soum) and end users including herders and general public
- 5.4. To procure and set up equipment for seminars/workshops
- 5.5. To conduct surveys to assess the needs of weather information and level of understandings for end-users (public administrators, nomads, etc.)
- 5.6. To analyze the survey results and provide feedback to the related project activities

Pre-conditions

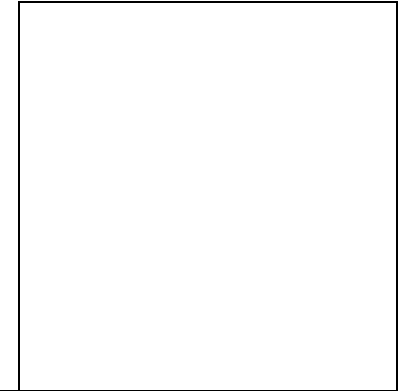
To be able to obtain cooperation of organizations/agencies related to natural disaster management

OUTPUT 6 - Weather observation and forecasting systems especially weather radar and computer network are stably operated.

- 6.1. To produce operation and maintenance manual of weather radar system
- 6.2. To conduct training on operation and maintenance of weather radar system
- 6.3. To make overall plan of computer network in NAMHEM
- 6.4. To conduct training on computer networking

OUTPUT 7 - Information on monitoring of DSS is issued.

- 7.1. To procure and set up DSS monitoring system
- 7.2. To conduct training on operation and maintenance of DSS monitoring network and data analysis



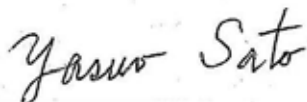
6. THE SUBJECT DETERMINED IN THE JCC

The Minutes of the Joint Coordinating Committee (JCC) held on 5 March, 2008 are attached hereunder.

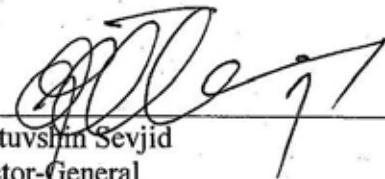
Minutes of Meeting
on
the Technical Working Group Meeting
of
Project for Development of Human Capacity for Weather Forecasting and
Data Analysis in Mongolia

The series of discussions on the captioned project among the officials concerned was made. As the result of the discussions, both sides have confirmed the main items described in the attached sheets.

Ulaanbaatar, March 5, 2008



Yasuo Sato
Team Leader
JICA Project Team



Enkhtuvshin Sevjid
Director-General
National Agency for Meteorology,
Hydrology and Environment Monitoring

ATTACHMENT

1. Project Name

The Project for Development of Human Capacity for Weather Forecasting and Data Analysis in Mongolia

2. Implementing Agency

National Agency for Meteorology, Hydrology and Environment Monitoring (NAMHEM)

3. Relevant Items discussed

- 1) Report on activities in the Japanese fiscal year 2007 and plan of activities in the first half of Japanese fiscal year 2008

The activities done and its outputs achieved in the Japanese fiscal year 2007 and the prospect of its achievements in the Japanese fiscal year 2008 were presented by the JICA experts.

The Mongolian side expressed their expectation that the numerical weather prediction for five-day forecast would be commenced by the completion of the Project using the output of the numerical weather prediction model of Japan Meteorological Agency as the boundary condition.

Regarding the progress of introduction of 'guidance' for long-range forecast, the Japanese side explained that the counterpart personnel had been implementing the activities with support of the chief adviser of the JICA expert team utilizing the technology which had been transferred on 'ensemble forecast' by the related JICA expert to the counterpart personnel during the phase of basic training in the Project and continual efforts of the counterpart personnel would accomplish the final goal of the output on this field in the Project.

Regarding the field of drought and dzud early warning system (hereinafter referred to as "DDEWS"), the Mongolian side explained that DDEWS itself had not been established even though a pasture condition map and other related results had been accomplished as parts of DDEWS. Also the Mongolian side explained that the definition of 'dzud' was being discussed and reviewed in the Government of Mongolia according to the climate change in the recent years and the guideline of DDEWS would be authorized by NAMHEM after the review.

Regarding dust storm and yellow sand monitoring network, the Mongolian side mentioned that discussions on the framework of this field had been being made among China, Japan,

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Korea, Mongolia. The Mongolian side also mentioned that the function of the air quality management of the Ministry of Nature and Environment had been shifted to NAMHEM recently.

4. Other Relevant Issues discussed

1) Completion evaluation to be conducted by JICA

JICA explained that JICA would dispatch a completion evaluation team comprising officials of JICA and consultants to be contracted by JICA in June, 2008 and the main purpose of the evaluation was to confirm whether the Project Purpose and the Outputs were achieved. The Mongolian understood the purpose and expressed their commitment to support activities of the team for smooth implementation of the evaluation.

2) Time to be spared by counterpart personnel for the implementation of the Project activities and for utilization of the technologies transferred after the completion of the Project

The Japanese side expressed their suggestion that, referring to the recommendation by the mid-term evaluation team dispatched in August, 2006, more staff of NAMHEM should be assigned for each of the fields to avoid from any suspensions of the activities of the Project and to assure continual operation even with long term absence of some of the key personnel. The Mongolian side expressed their intention that maximum considerations were taken for the counterpart personnel to work with the Japanese experts during their stay in Mongolia. The Mongolian side also mentioned that staff allocation to cover the continual operation of the system for each of the fields after the completion of the Project was given priority in the personnel policy of NAMHEM and any efforts to allocate its staff was still required.

3) Measures taken in response to the recommendations of the Minutes of Meeting on the Mid-term Evaluation signed on August 25, 2006

The Mongolian side mentioned that the steering committee for the Project had been established among Ministry of Nature and Environment, NAMHEM and JICA in 2006. The list of the members of the steering committee will be circulated among the persons concerned.

The Mongolian side emphasized that the counterpart personnel had been learning English by themselves and by internal short-term learning courses to improve their English proficiency level.

4) Equipment and training in Japan proposed for the Japanese Fiscal Year 2007

The Mongolian side inquired for any possibilities of provision in the Japanese fiscal year

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2008 of the equipment for the forecast support system which had been proposed for the Japanese fiscal year 2007. The Japanese side recognizes its necessity and requested the Mongolian side that the equipment would be prepared by the Mongolian side under the circumstances of affordable increased revenue of the Government of Mongolia. The Mongolian side agreed that they would make necessary arrangement for the provision of the equipment from their side.

The Mongolian side also inquired for any possibilities of provision in the Japanese fiscal year 2008 of the training in Japan for weather forecasting technique proposed for the Japanese fiscal year 2007. The Japanese side explained that JICA had been making their maximum efforts for the inputs from the Japanese side and the level for knowledge and skills of the counterpart personnel was enhanced to the degrees where they could accomplish the activities concerned on their own. The Mongolian side agreed with the exclusion of the provision in the Japanese fiscal year 2008.

The Japanese side reminded the Mongolian side that in the scheme of technical cooperation of JICA a certain portion of the Project was never agreed on at the time of its commencement and the budget was allocated annually accordingly. The Mongolian side understood that all the planned inputs from the Japanese side for the Project are subject to the budget of the Government of Japan.

Annex-1 'List of Attendants of the Meeting on Project Implementation'

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List of Attendants

of

the Meeting on Project Implementation

For

The Project for Development of Human Capacity for Weather Forecasting and Data Analysis

Location: Conference Room, National Agency for Meteorology, Hydrology and Environment

Monitoring (NAMHEM), Ulaanbaatar

Time: 10:00, 5 March, 2008

Name	Position
Mr. Enkhtuvshin Sevjid	Project Director and Director General, NAMHEM
Dr. Erdenebat Eldev-Ochir	Project Manager
Mr. J. Tsogt	Head, Weather Forecast Section (WFS), Institute of Meteorology and Hydrology (IMH)
Mr. P. Gomboluudev	Chief, Forecast Research Laboratory (FRL), WFS, IMH, NAMHEM
Mr. A. Batbold	Researcher, FRL, WFS, IMH, NAMHEM
Ms. L. Oyunjargal	Researcher, FRL, WFS, IMH, NAMHEM
Mr. G. Bayasgalan	Researcher, FRL, WFS, IMH, NAMHEM
Mr. B. Buyantogtoh	Engineer, FRL, WFS, IMH, NAMHEM
Mr. D. Batdorj	Engineer, Climate Study Section, IMH, NAMHEM
Ms. B. Gaandulam	Ministry of Finance and Economy
Mr. Tsutomu Moriya	Resident Representative, Japan International Cooperation Agency (JICA)

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Ms. B. Tuguldur	Program Officer, JICA
Dr. Yasuo Sato	Leader of JICA expert team
Dr. Masataka Nishikawa	National Institute of Environmental Studies of Japan
Mr. Hiroaki Mizukami	JICA expert

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List of Attendants

Name	Position
<p>ᠶᠡᠫᠡᠨᠢᠪᠠᠢ</p> <p>E. PROENEBAI</p>	<p>ГХХ-ний газар</p>
<p>P. GOMBOZHUNDEV</p> <p>ᠯᠡᠭᠡᠨᠠᠨᠠᠭᠤᠨᠠᠨᠠᠭᠤ</p>	<p>Chief, Forecast Research Lab.</p> <p>ᠯᠡᠭᠡᠨᠠᠨᠠᠭᠤᠨᠠᠨᠠᠭᠤ</p>
<p>A. TARDAY</p> <p>A. BATBOGA</p>	<p>Researcher, FRL</p>
<p>X. UOUI</p> <p>J. TSOGT</p>	<p>Head, weather forecast section</p> <p>ᠯᠡᠭᠡᠨᠠᠨᠠᠭᠤᠨᠠᠨᠠᠭᠤ</p>
<p>G. BARCHIMIG</p> <p>ᠲᠡᠪᠠᠷᠴᠢᠮᠢᠭᠢ</p>	<p>engineer, FRL</p> <p>ᠯᠡᠭᠡᠨᠠᠨᠠᠭᠤᠨᠠᠨᠠᠭᠤ</p>
<p>B. BUYANTOGTOH</p> <p>ᠪᠤᠶ᠋ᠠᠨᠲᠣᠭᠲᠣᠬᠤ</p>	<p>engineer, FRL</p> <p>ᠯᠡᠭᠡᠨᠠᠨᠠᠭᠤᠨᠠᠨᠠᠭᠤ</p>
<p>L. DYUNTARGAL</p> <p>ᠯᠡᠳᠤᠨᠲᠠᠷᠭᠠᠯ</p>	<p>Full, production</p> <p>ᠯᠡᠭᠡᠨᠠᠨᠠᠭᠤᠨᠠᠨᠠᠭᠤ</p>
<p>D. BATDORJ</p> <p>ᠳᠡᠪᠠᠲᠣᠷᠵᠢ</p>	<p>YACC - unmet</p> <p>engineer, climate study section</p>
<p>B. GAADUBAM</p> <p>ᠪᠡᠭᠠᠳᠤᠪᠠᠮ</p>	<p>Lawyer</p>
<p>Yasuo SATO</p>	<p>Chief Adviser, JICA Expert (GWA)</p>
<p>Masataka NISHIKAWA</p>	<p>NIES</p>
<p>Hiroaki MIZUBAMI</p>	<p>JICA expert, (GWA)</p>

Annexes

1. Pictures in activities in each field

2. Outputs (in separate volumes)

	Field	Outputs
Annex 1	Numerical Weather Prediction	Middle-term forecast (provided once a day)
Annex 2	Climate Change Projection	Information on climate change due to global warming over Mongolia
Annex 3	Weather Forecasting	Short-term forecast (provided twice a day)
		Long-term forecast (provided twice a year)
		Computer-aided case study handbook on typical and unusual phenomena
Annex 4	Weather Interpretation Method	Suggestion for the Precipitation Guidance using Product of RSM of mean rainfall amount
Annex 5	Drought/Dzud Early Warning System GIS Technique Zoo-meteorology	Information on drought/dzud provided annually (at the end of August)
		Maps of pasture biomass on the village (bag) scale, outline
		Information on drought/dzud provided on the web (Vegetation map, Biomass map, Drought map and Snow map)
		Maps of plant height on the village (bag) scale
		Guideline of warning and advisory messages
		Revised zoo-meteorological observation program
Annex 6	Use of Weather Information	Revised zoo-meteorological observation manual
		Participants list of workshops
		Results of questionnaire survey
Annex 7	Operation and Maintenance of Weather Radar System	Leaflet on practical use of weather information
		Operation and maintenance manual of weather radar system
Annex 8	Computer Networking	AVR and UPS Check Sheet (Weekly)
		Overall plan of computer network in NAMHEM
Annex 9	Dust and Sand Storm (DSS) Monitoring Network	The problems and the future expansion plan of the NAMHEM network
		Equipment for Kosa Monitoring Network
		DSS monitoring data