Executive Summary for Terminal Evaluation

I. Outline of the Project		
Country: People's Republic of China		**Project Title:** Japan-China Meteorological Disaster Reduction Corporation Research Center Project
Issue/Sector: Meteorology/ Disaster reduction		**Cooperation Scheme：** Technical Cooperation
Division in charge： JICA China Office		Total cost： million Yen
Period of Cooperation	**(R/D):** From Aug. 2005 to June. 2009	**Partner Country's Implementation Organization：** China Meteorological Administration (CMA) Chinese Academy of Meteorological Sciences (CAMS)
		Supporting Organization in Japan: University of Tokyo, Japan Weather Association (JWA)

1. Background of the Project

In China, meteorological disasters such as floods, droughts, typhoons and cold weather cause serious economic loss and loss of human lives every year. In spite of the efforts of the Government of China (GoC) in strengthening the meteorological observation network including Doppler Rader and satellite observation, it is a fact that the number of the weather stations in the Western region is fewer than that of Eastern region. While the GoC is devoting efforts to improve the overall meteorological observation systems, prediction of weather and meteorological disasters in the Western region, particularly in the Tibet Plateau, is low due to the low observation density in the area.

Under this circumstance, in order to improve the atmospheric comprehensive observation system in the above area and to enhance the prediction of weather and meteorological disasters, the GoC requested the Government of Japan for technical cooperation, including equipment for Automated Weather Station (AWS) observation (in the Tibet Plateau), Global Positioning System (GPS) observation (in Yunnan Province, Sichuan Province, Tibet Autonomous Region) and numerical model development (Beijing), software development, Japanese experts and trainings in Japan.

After interviews and field visit, the Project was adopted in September 2004. JICA conducted appraisals twice in 2005 and agreed with the GoC on the overall contents of the Project. Since December 2005, the Project has been implemented.

2 Project Overview

(1) Overall Goal

Meteorological disaster is reduced in East Asia including China and Japan

(2) Project Purpose

The operational weather forecasting system of China is strengthened through the development of numerical weather prediction models importing the data obtained by the quantitatively and qualitatively improved observation systems in the Tibet Plateau and its eastern surrounding area.

(3) Outputs

1) An on-line vapor observation network in the Tibet Plateau and its eastern surrounding area is established.
2) An integrated meteorological observation network covering the Tibet Plateau and its eastern surrounding area is established.
3) Intensive observations of the atmosphere-land interaction in the Tibet Plateau and its eastern surrounding area are carried out.
4) Integrated satellite application systems are established.
5) Data system for maximum use of the observed data in the Tibet Plateau and its eastern surrounding area is established.
6) Understanding of meteorological and hydrological variation mechanisms in Tibetan Plateau and its eastern surrounding area, which are closely related with weather disasters and water resources in China and East Asia, is enhanced.
7) Numerical weather prediction models in meso- and regional- scales, in which the observed data in the Tibet Plateau and its eastern surrounding area is effectively used, are developed.
8) Demonstrations, which illustrates that the improvement of heavy rainfall prediction contributes to public and social benefits, are carried out.

(4) Inputs

Japanese side： Short-term Expert 15 persons

	Equipment	302,403 thousand Yen　Local cost　43,380 thousand Yen
	Trainees received	14 persons (including 2 persons for FY 2009)
Mongolian side :	Counterpart	Total 85 persons (57 persons at the start of the project)
	Land and Facilities	Project office (Beijing, Chengdu, Lhasa, Kunming)
	Local Cost	4069.8 million Chinese Yuan (equivalent of 583,853 thousand yen)

II. Evaluation Team		
Members of Evaluation Team	1) Leader: Mr. Kojiro MATSUMOTO, Team Leader, Deputy Resident Representative, JICA China Office 2) Planning Evaluation 1, Mr. Mitsuaki Okubo, Assistant Resident Representative, JICA China Office 3) Planning Evaluation 2, Mr. Jun Xing, Program Officer, JICA China Office 4) Evaluation Analysis, Ms. Junko MIURA, Researcher, Social Development Department, Global Link Management Inc.	
Period of Evaluation	From March 12, 2009 to March 25, 2009	**Type of Evaluation :** Terminal Evaluation

III. Results of Evaluation

The Project divided the project period into three phases: (1) phase for establishing the observation system and developing prediction models (December 2005-September 2007); (2) phase for operating the established system and improving the developed models (October 2007- August 2008); and (3) phase for performance evaluation of the observation system and prediction models (September 2008– June 2009). The extent of the achievement of the Outputs is judged as good or excellent except the Output (8) Demonstration. The achievements of Outputs and Project Purpose are summarized as follows.

<Outputs>

Output 1: An on-line vapor observation network in the Tibet Plateau and its eastern surrounding area is established

It can be said that Output 1 has been achieved more than planned. GPS vapor measurement equipment was installed at the twenty four stations as planned. More than ninety percent of the online observation data have been obtained from all the twenty four GPS stations. Approximately fifty technical observation staff (two staff per station) have been trained and maintained. According to the questionnaire conducted in March 2009 shows that most of the staff has already obtained basic management capacity in terms of the operation of observation equipment, data collection and data accumulation.

Output 2: An integrated meteorological observation network covering the Tibet Plateau and its eastern surrounding area is established.

It can be said that Output 2 has been achieved more than planned. More than ninety percent of per-hour data of on-land temperature, humidity, wind direction, wind speed and precipitation have been obtained at the existing sixty four Automated Weather Stations (AWSs) out of the existing sixty five stations while the indicator in PDM was eighty percent. In addition, more than ninety percent of per-hour data have been obtained at all the seven newly established AWSs. For the rest of the Project, it is important for the staff to further strengthen advanced management capacity.

Output 3: Intensive observations of the atmosphere-land interaction in the Tibet Plateau and its eastern surrounding area are carried out.

It can be said that Output 3 has been almost achieved. Intensive observations of the atmosphere-land interaction in the Tibet Plateau and its eastern surrounding area were carried out three times basically as planned. Continuous data has been obtained at the five Planetary Boundary Layer (PBL) stations (three new stations and two existing stations) while there is lack of few data. With respect to the wind profiler in Naqu, which has system error, it is necessary for the Project Team to discuss how to recover it. Through the trainings in Japan, six experts have been trained for PBL and two for Wind Profiler.

Output 4: Integrated satellite application systems are established.

It can be said that Output 4 has been achieved more than planned. More than ninety percent of experimental products of soil moisture, snow cover, precipitation, cloud and water vapor as well as atmospheric temperature have been obtained.

Output 5: Data system for maximum use of the observed data in the Tibet Plateau and its eastern surrounding area is established.

It can be said that Output 5 has been almost achieved. By using the obtained data from the Project, a data system for data quality check, data archive and search was developed and established in the China Meteorological Administration (CMA) and Chinese Academy of Meteorological Sciences (CAMS). It is expected that the obtained data from the Project will be opened by July 2010 in accordance with the data policy of Asia Monsoon Year (AMY) Project under the World Climate Research Plan (WCRP).

Output 6: Understanding of the meteorological and water cycle mechanism in the Tibet Plateau and its eastern region, which are closely related with weather disasters and water resources in China and East Asia, is enhanced.

It can be said that Output 6 has been achieved more than planned. Japanese and Chinese experts jointly compiled and analyzed the obtained data and produced papers with new insight. Twenty two papers (twenty for Chinese experts, two for Japanese experts) were published or are waiting for printing in international publications, and thirty eight papers (thirty four for Chinese, four for Japanese) were published or are waiting for printing in Chinese publications. In total, sixty papers (fifty four for Chinese, six for Japanese) were published or are waiting for printing in Chinese and international publications.

Output 7: Numerical weather prediction models in meso- and regional- scales, in which the observed data in the Tibet Plateau and its eastern surrounding area is effectively used, are developed.

It can be said that Output 7 has been achieved. Through the Science Workshop, mini-workshops, seminars and trainings in Japan, five to six experts who can develop numerical weather prediction models have been trained. Numerical weather prediction models importing the obtained data from the Project were developed. These models were built into the performance evaluation verification system, and several cases showed the improvement of heavy rain prediction.

Output 8: Demonstrations, which illustrates that the improvement of heavy rain prediction contributes to public and social benefits, are carried out.

Output 8 has not been achieved yet at the time of the terminal evaluation. The Project Team had discussions on selecting proper case studies for verification of heavy rain prediction accuracy and for costing how much economic loss is reduced by heavy rain prediction. The team also discussed planning for demonstrations which illustrates how much economic loss and loss of human lives are reduced by heavy rain prediction and signals. In addition, it held a seminar regarding flood prediction models for demonstrations. However, as the responsible agency for water resources has not provided river flow data, demonstrations have not been carried out.

<Project Purpose>

The operational weather forecasting system of China is strengthened through the development of numerical weather prediction models importing the data obtained by the quantitatively and qualitatively improved observation systems in the Tibet Plateau and its eastern surrounding area.

By using the numerical weather prediction models developed by the Project, the weather prediction illustrated its improvement at the operational level. For example, at the time of heavy snow in the beginning of 2008 and heavy rain from June to July in the Southern China, the weather prediction result by using the models was evaluated by the performance verification system, which showed effectiveness of the models. Considering the extent of achievements of the five indicators holistically, it can be said that the operational meteorological forecasting system of China has been strengthened. If the observed data from the Project is opened as planned and if the responsible agency for water resources provides data for river flow, the level of achievement of the Project Purpose will be further enhanced.

2. Summary of Evaluation Results

(1) Relevance

According to the 11th National Economic and Social Development Five Year Plan of the Government of China (GoC) for 2006-2010, it states that the GoC shall enhance the capacity of weather disaster prediction

and improve weather prediction accuracy and timeliness. GoC has also been promoting a long-term plan for building the comprehensive meteorological observation system all over in China. Therefore, it is said that the Project has high compatibility with the Chinese development policies. Meanwhile, according to the Japan's Economic Cooperation Plan for China, Japan put a high priority on the global issues such as the environmental protection. Joint communiqué between President Hu and former Prime Minister Fukuda in May 2008 also states that Japan and China cooperate on environmental protection and climate changes. Therefore, the Project also has high compatibility with the Japanese cooperation policies for China. In addition, the approach of the Project is also highly appropriate because that the meteorological observation system in the Tibet Plateau is fragile, that the Project was developed based on the long-term Japan-China joint research cooperation and mutual trust relationship, and that the Japanese scientific technology and rich experiences were fully utilized.

(2) Effectiveness

Each output has been progressed as planned or more than planned except Output 8. Outputs were organized in chronological order in line with the three phases: development of the observation system and its operation; development of the meteorological prediction models and their improvement; and performance evaluation of the system and the models. Through this process, the outputs dovetail into the Project Purpose, which aims to strengthen the operational meteorological prediction system. While it can be said that the Project Purpose has already been achieved, if the observed data is opened as planned and if the agency responsible for water resources provides required data for demonstration (Output 8), the extent of achievement of the Project Purpose will be further enhanced.

(3) Efficiency

It was confirmed that inputs by the Japanese side (dispatch of Japanese experts, trainings in Japan, provision of equipment, etc) were provided properly in terms of quantity, quality and timing, and that the Japanese inputs were fully utilized for the achievement of the Project Purpose. Although the Project Team encountered various difficulties when they installed equipment, the efficiency of the Project remained high because of the joint cooperation with the Chinese counterparts (CMA, CAMS, meteorological administration offices, observation stations and institutes in the target areas) in the administrative implementation. Chinese side provided more financial inputs than Japanese side, and also provided necessary human resources and facilities properly. In particular, while the number of Chinese counterparts stood at fifty seven persons at the beginning of the Project, it drastically increased to eighty five persons at the time of terminal evaluation. The project is monitored properly through the Joint Coordination Committee (JCC) (once a year), Science Workshops (twice a year), telephone conferences, etc. In FY2008, the Project Team also held administrative meetings and the Japanese experts opened a common website to share the information regarding the progress of each activity and administration.

(4) Impact

Integrated observation system established by the Project has been used by the counterparts with its own budget in other stations in the Tibet Plateau and its neighboring provinces as well as the National Key Integrated Meteorological Observation Station (Supersite) in Dali. The counterparts in Siquan Province and Yunnan Province who received technical cooperation from Japanese experts have been regarded as key resource persons of the observation techniques in the target area. These key resource persons have been providing trainings and guidance to technicians in other provinces and regions such as the Tibet Autonomous Region and Yunnan Province. Meanwhile, based on the research results of the Project, many papers have been published in internationally renowned publications of the American Geophysical Union and the American Meteorological Society. This made it possible to demonstrate the Project's international contribution, which has been known widely among academia and practitioners. Furthermore, the Project has been contributing as primary part of the following systems and projects: China Earth Observation System of Systems (CEOSS), China Climate Observing System (CCOS), observation system of the Western Route of South-North Water Transfer Project, Asia Monsoon Year (AMY) Project, The Observing System Research and Predictability Experiment (THOREX) Plan under the World Meteorological Organization (WMO), etc.

(5) Sustainability

The sustainability of the Project in a policy aspect is high because that the Government of China (GoC) has established CCOS and because that it has been promoting long-term plans such as CEOSS Ten Year

Plan. The sustainability of the Project in a financial aspect is also high because that the Chinese portion of the Project's budget has already been incorporated in the operational budget of the CMA, because that the GoC has contributed more financial and human resources to this Project than the GoJ, and because that it secures budget to maintain the established observation systems even after the termination of the Project. In technical aspect, according to the questionnaire, most of the experts at the stations have developed basic capacity in operating equipment and data collection and data accumulation. Manual for observation equipment such as Automated Weather Station and Planetary Boundary Layer jointly developed by Japanese and Chinese experts is frequently used by the Chinese experts. Trouble shooting Q&A has also been developed by the Japanese experts and will be shared with Chinese experts in short time. In addition, with its own initiative, key resource persons in Siquan Province and Yunnan Province have developed their own GPS operation manuals. CAMS has also developed installation manuals for GPS equipment when the Project installed GPS equipment in 2006. CAMS utilizes the manuals as well as its knowledge, techniques and experiences, which were acquired from the Project, when it installs GPS equipment by itself in Hubei Province, Guizhou Province and Guangxi Province outside the Project target area. In research and development (R&D) aspect, judging holistically from the number of publications, level of publications and academic activities of counterparts, capacity of counterparts in R&D leading to operational results has been developed not only at the central level but also at the provincial level.

3. Factors that promoted realization of effects

(1) Factors concerning to Planning

Factors that promoted realizations of effects, concerning to planning, are the followings: that the Project was developed based on the Japanese and Chinese long-term research cooperation and mutual trust relationship; that the Project aimed at strengthening the operational meteorological prediction system by dividing the Project into three phases and by achieving outputs step by step; that the Project positioned Science Workshops as the opportunity for monitoring the progress of the project activities as well as for sharing advanced science and technology between Japanese and Chinese experts; and that the Project made clear the division of roles among central, provincial and station levels for efficient implementation of activities; that the Project fully utilized the opportunity of dispatching experts for providing guidance comprehensively from handling of equipment and data to maintenance of equipment, and that it also made the best use of the opportunity of counterpart trainings for intensive guidance and information sharing in each research area.

(2) Factors concerning to the Implementation Process

Factors that promoted realization of effects, concerning to the implementation process, are the followings: that the Chinese counterparts were keen to improve the meteorological prediction accuracy; both Japanese and Chinese experts were researchers of the first class; and that experts of both sides from different research topics, organization and locations cooperated with each other; that Japanese and Chinese team leaders played great roles in leading the Project team; that several Chinese young experts researching under Japanese experts, as members of the Project team, played a role in smooth communication between Japanese side and Chinese side; that intensive and specialized opinion exchange and technical exchange by research area have been promoted through mini-workshops and seminars; that the members of the counterparts remain almost the same (and the number of the counterparts are increasing); and that intensive observation was carried out almost as planned even after the big earthquake in Siquan Province in 2008 thanks to the special consideration.

3. Factors that impeded realization of effects

(1) Factors concerning to Planning

No particular factors have been observed.

(2) Factors concerning to the Implementation Process

The Project has not carried out demonstrations related to Output 8 since the agency responsible for water resources has not provided river flow data. This is considered as the influence of the important assumption.

3-5 Conclusion

While the Project has been implemented in the Tibet Plateau and its eastern surrounding areas, where comprehensive observation is very difficult due to the severe natural environment, the evaluation result

shows that the Outputs except the demonstration (Output 8) were achieved as planned or more than planned at the time of evaluation.

It can be said that the Project Purpose of "strengthening the operational meteorological prediction system" has been achieved, but if the responsible agency for water resources cooperates with the Project, it is probable that the achievement level of the Project Purpose will become higher. In all the five evaluation criteria, quite good results were demonstrated. The observation network established by the Project has already been incorporated in the operational observation system network of the CMA and the observation stations network of the Chinese Academy of Science (CAS) as well as the Chinese national projects such as the Western Route of South-North Water Transfer Project.

The established network has also been linked with the international research framework such as AMY and Global Earth Observations System of Systems (GEOSS), and this produced synergy effects by utilizing the Project's results combined with other network and systems. Furthermore, more than planned number of papers were written and some of them were published in internationally renowned publications. Considering these impacts, it can be said that the Project contributed to the advanced meteorological research not only in China and Japan but also globally. In the near future, it is expected that the counterparts further strengthen the operational meteorological prediction system by utilizing the developed numerical meteorological prediction model while making efforts to obtain cooperation from the responsible agency for water resources, thereby contributing to the reduction of meteorological disaster, which is the overall goal of the Project.

3-6 Recommendations

(1) It is recommended to continuously cooperate with the China Meteorological Administration (CMA) and the Ministry of Water Resources and provincial authorities responsible for water resources.
(2) It is recommended to further strengthen advanced management capacity of the technical experts through site visits by the Japanese experts and trainings data quality control.
(3) In order to contribute to promote Asia Monsoon research and global energy/water cycle research, it is recommended to open the observed data by the Project at earliest timing in accordance with the data policy agreed at the Joint Coordination Committee in March 2009.
(4) Both Japanese and Chinese sides need to cooperate with each other in order to recover the system error of the Wind Profiler installed at Naqu at earliest timing.

3-7. Lessons Learned

(1) It was extremely effective to increase efficiency of the Project by utilizing the long-term trust and cooperative relationship between Japanese and Chinese scholars over twenty years.
(2) For the projects covering various research issues, it is effective to organize different thematic groups and to decide leaders for each group. It is also effective to organize mini-workshops and/or trainings on specific themes.

It was effective that several Chinese scholars who have been researching in the concerned themes and have been participating in the Project as members of the Japanese team assisted the Japanese and Chinese Project Leaders in communication. They also contributed to the technical cooperation with Chinese experts by having lectures on the concerned themes directly in Chinese language. All these contribution to communication and technical cooperation was very effective.