Activity Report of Tokyo Climate Center in 2006

Tokyo Climate Center, Japan Meteorological Agency

1. Operational changes in 2006

1-1 Upgrade of GDPFS at JMA

In March 2006, the Global Data-Processing and Forecasting System at JMA was upgraded, and several changes were introduced in the operational climate data assimilation and seasonal ensemble prediction systems.

a) The JMA Climate Data Assimilation System (JCDAS) was implemented into operation. JCDAS inherits the data assimilation system used in the Japanese 25-year Re-analysis (JRA-25, see section 5-1). JRA-25 and JCDAS data compose long-term and quality-consistent analysis data that enable us to perform better climate system monitoring and diagnosis.

b) The Sea Surface Temperature (SST) analysis system was upgraded to the same one used in the centennial SST reanalysis (Ishii et. al., 2005), which used optimum interpolation method with sophisticated data quality check. The new SST analysis, called COBE-SST, has spatial resolution of 1 degree latitude and 1 degree longitude and temporal resolution of one day. The COBE-SST is used for El Niño/La Niña monitoring, climate change monitoring and the boundary conditions of seasonal prediction.

c) The extended-range (one-month) Ensemble Prediction System (EPS) was separated from the medium-range EPS. The number of ensemble members was increased from 26 to 50. The atmospheric global prediction model for the extended-range EPS was upgraded to the medium-resolution version (TL159L40; about 120km grid interval) of the JMA Global Spectral Model for short-range forecasting introduced in July 2005 (GSM0507), in which the semi-Lagrangian scheme and the improved clear-sky/cloud radiation schemes were incorporated. The COBE-SST started to be used as the boundary condition.

d) The long-range (three-month and warm/cold season) EPS was upgraded to the low-resolution version (TL95L40; about 180 km grid interval) of the JMA Global Spectral Model for short-range forecasting introduced in February 2005 (GSM0502), in which the improved cumulus scheme, the improved albedo of snow and ice, and a cloud scheme with cloud water as a prognostic component were incorporated in addition to the semi-Lagrangian scheme and the improved clear-sky/cloud radiation schemes. The number of ensemble members remained 31.

1-2 Modification of the index of El Niño and La Niña

In March 2006, in concurrence with the implementation of COBE-SST into operation, JMA modified the index of El Niño and La Niña. The most recent 30-year sliding mean was started to be used for the climatological reference instead of the fixed reference of the 1961-1990 average. The region for averaging was slightly changed to the identical region with the one commonly called NINO.3 (5°N-5°S, 150°W-90°W), instead of the former one called Region B (4°N-4°S, 150°W-90°W). The new index is defined as the five-month mean of the NINO.3 SST deviation from the reference SST, defined as the recent 30-year mean. The definition of El Niño (La Niña) events was not changed: that is, an El Niño (La Niña) period is defined as the period when the index continues to be higher (lower) than +0.5°C (-0.5°C) for longer than six consecutive months.

Because of the introduction of COBE-SST and new definition of the index of El Niño and La Niña, the historical periods of the El Niño and La Niña events were reexamined and identified. Before 1990, the periods of those events are almost the same as the previous ones. After 1990, when warming tendency became apparent in the equatorial SSTs over the Pacific, a weak El Niño event, which was identified in 1993 according to the previous definition, is no longer identified under the new definition. In contrast, a La Niña event is newly identified from boreal summer in 1995 through winter 1995/96, and the two La Niña events which were separately identified by the former definition during the years from 1998 to 2000, are identified as a single event.

A separated volume of the Monthly Report on Climate System, containing the features of the COBE-SST and the new index of El Niño and La Niña, was published in March 2006. It is available from the TCC website (http://okdk.kishou.go.jp/MRCS_SV12/index_e.htm).

1-3 Start of monitoring of the global surface temperature anomaly

In May 2006, JMA started providing global surface temperature anomalies derived from observation data combined not only over land but also over the ocean for monitoring of the global warming on monthly and annual bases. The land part of the combined data are composed of the Global Historical Climatology Network (GHCN) data from 1880 to 2000 provided by the National Climatic Data Center (NDWC) of USA and CLIMAT messages after 2000 archived in JMA. The oceanic part is comprised of the COBE-SST (see section 1-1 b).

The detailed analysis procedures and the monitoring results are available from the TCC website (http://okdk.kishou.go.jp/products/gwp/gwp.html).

2. Monitoring and analysis of global extreme climate events in 2006

2-1 Extremely cold weather in northeastern Asia and predominant convective activity across the Bay of Bengal to the Philippine Sea in December 2005

In December 2005, it was extremely cold over northeastern Asia, and monthly mean temperature of Japan was the lowest since 1948. It was found from JMA's examinations that the extremely active cumulus convection over the Bay of Bengal, the South China Sea and the Philippine Sea was deeply related to the cold weather, besides the influence of the persistency of the negative phase of the Arctic Oscillation (AO). The stationary Rossby wave train along the strong Asian Jet, which was excited by the active cumulus convection over those areas, caused the persistent and large-amplitude meandering of the jet, leading to the repetitive cold air outbreaks in and around Japan. The active convection seems to be excited partly due to the La Niña event started in autumn 2005. A report on the topic is available from the TCC website (http://okdk.kishou.go.jp/news/topics_20060127.html).

2-2 Stratospheric major warming event in January 2006

An unusual stratospheric major warming occurred in the end of January 2006. In the event, developed ridge over central Siberia was remarkable at 30 hPa with rapid warming and temperature over the North Pole reached to 40 °C higher than its normal. It was shown by this analysis that vertical and horizontal energy propagation of planetary-scale waves from the troposphere to the stratosphere played an important role in the major warming. There is an article on the topic in the TCC News No.4 (http://okdk.kishou.go.jp/news/tccnews04.pdf).

2-3 Landslide in the Philippines in February 2006

On 17 February, a large-scale landslide occurred in Leyte Island, the Philippines. It was reported that more than 1000 persons died and missed. Up until several days before the landslide, about 500 mm of total precipitation for five days was observed at a nearby station. It was analyzed that this heavy rain was caused by the sustained active convection due to the confluence of strong trade wind and cold surge from the Eurasian Continent, in addition to the orographic effect.

2-4 Sea ice conditions in the Okhotsk Sea in the 2005/2006 winter season

Sea ice area in the Okhotsk Sea was smaller than normal throughout the period from December 2005 to April 2006. It was the smallest since 1971 in the second 10-days of December and the first 10-days of January. Sea ice area reached its seasonal maximum of 0.90 million square kilometers on 10 March, which was smaller than the normal extent of 1.22 million and the second smallest only to 0.86 million for the year 1984. A report on the topic is available from the TCC website (http://okdk.kishou.go.jp/news/topics_20060526.html).

2-5 Short-duration La Niña event in 2005/2006

A La Niña event occurred from autumn 2005 to spring 2006. It was the first La Niña event for five and a half years. Autumn was the latest season for the timing of the development and the six-month duration was the shortest among the historical La Niña events since 1949. The impacts of this La Niña event on atmospheric circulation and surface climate were clear in the tropical Pacific as seen in the past events, while they were less clear in the mid- and high-latitudes. There is an article on the topic in the TCC News No.5 (http://okdk.kishou.go.jp/news/tccnews04.pdf).

2-6 Extremely heavy rain in Japan during 15-24 July 2006

During 15-24 July 2006, active Baiu front continued to be located over Japan, and brought heavy rainfall which lasted for several days in western and eastern Japan. Seven-day accumulated rainfall during 18-24 July exceeded 1,200 mm in the southern part of Kyushu in western Japan, which was above twice as much as normal monthly rainfall for July. At tens of observatories in western and eastern Japan, accumulated precipitation during 15-24 July recorded above twice as much as normal monthly precipitation for July.

Due to this prolonged and sustained Baiu frontal activity, the end of Baiu season, rainy season in Japan, was delayed for about 10 days from its normal dates in western and eastern Japan.

The main reasons for the sustained active Baiu front are thought as follows:

1. cold upper-air continuously flowed into Japan by the quasi-stationary and remarkable meander of the sub-tropical jet,
2. warm and humid lower-air continuously flowed into Japan along the western periphery of stronger-than-normal sub-tropical high south of Japan.

These two flows joined over Japan and made atmospheric vertical stability quite unstable. This condition was favorable for enhanced and sustained Baiu frontal activity. A report on the topic is available from the TCC website (http://okdk.kishou.go.jp/news/ topics_20060727.html).

2-7 Minimum in record of total ozone at Syowa Station, Antarctica

According to the observation conducted by the 47th Japanese Antarctic Research Expedition (JARE-47) at Syowa Station in Antarctica, the total ozone above the station broke the record of 128 m atm-cm on 6 October 1995, and reached its minimum in record of 114 m atm-cm on 17 October 2006, which is less than half the average before 1980 when the ozone hole hadn't appeared yet.

The establishment of the Antarctic ozone hole is attributable mainly to ozone depleting substances and meteorological conditions. While the density of the ozone depleting substances has remained high after its peak of the latter half of the 1990s, in 2006, the low temperature area of -78 °C or below, which is associated with the degradation of the ozone depletion, kept varying around the maximum level of the last 10 years. Therefore, it is thought that the ozone hole developed to the maximum level. A report on the topic is available from the TCC website (http://okdk.kishou.go.jp/news/topics_20061011.html).

3. International coordination activities in 2006

3-1 Application for GPC for LRF and RCC in RA-II

At the end of January 2006, the President of WMO Regional Association II asked the Director-General of JMA for submission for the Regional Climate Centre (RCC) status in RA-II. RCC Network in RA-II should conduct the following five functions; operational function, coordination function, data services function, training and capacity building function and research and development function. TCC of JMA has applied for it with its implementation plan, which is available at the TCC website (http://okdk.kishou.go.jp/about/implementation_plan_2006.pdf). The Working Group on Climate-Related Matters (WGCRM) in RA-II is examining its eligibility.

WMO’s Commission for Basic Systems (CBS) asked the member countries for submission for a Global Producing Centre for Long-Range Forecast (GPC for LRF) in February 2006. In August 2006 TCC of JMA has applied for the GPCs for LRF with a necessary activity report, which is available at the WMO website (ftp://www.wmo.int/Documents/SESSIONS/CBS.Ext(06)/English/pdf/d06-3(3)_en.pdf). After considering its achievements and capabilities, CBS approved the nomination in its extraordinary session, held in Seoul in November 2006.

3-2 Participation in regional and international conferences

In order to enhance the international coordination activity, some officials engaged in climate-related matters in the Climate Prediction Division (CPD) including TCC attended the international conferences and regional workshops in 2006.

a) Second Forum on Regional Climate Monitoring, Assessment and Prediction for Asia (Beijing, China: 6-8 April 2006)

Dr. Koichi Kurihara, Director of CPD, participated in the Forum as an invited lecturer and made presentations entitled “Recent development in climate information services in JMA” and “JMA’s outlook for summer 2006”. These presentation slides and related documents are available at the TCC website (http://okdk.kishou.go.jp/library/focraII _060412.html).

b) WMO Conference: Living with Climate Variability and Change - Understanding the Uncertainties and Managing the Risks - (Espoo, Finland: 17-21 July 2006)

Mr. Shingo Yamada, Head of TCC, participated in the Conference and made a poster presentation entitled “Development of "Early Warning of Unusual Weather Condition" by the JMA”. This presentation is available at the TCC website (http://okdk.kishou.go.jp/library/LWCVC_2006.html), and a participant’s report is documented in the TCC News No.6 (http://okdk.kishou.go.jp/news/tccnews06.pdf).

c) APEC Climate Center Symposium 2006 and the First Session of Member Working Group Meeting (Busan, Korea: 14-16 September 2006)

Dr. Hirotaka Kamahori, Senior Coordinator for Climate Modeling, participated in the Symposium and made presentations entitled “Japanese 25-year Reanalysis Project" and “Current Status and Future Plan of Seasonal Prediction System at the JMA”. These presentation slides are available at the TCC website (http://okdk.kishou.go.jp/library/APCC_sympo2006.html).

d) Seventh Joint Meeting of Seasonal Prediction on the East Asian Winter Monsoon (Beijing, China: 2-3 November 2006)

Mr. Shingo Yamada participated in the Joint Meeting and made presentations entitled “Summary of the JMA's Outlook for the 2006/07 Winter”, "Recent Progress of Climate-related Researches at JMA", “Verification of the Seasonal Forecast for the 2005/06 Winter” and “JMA's El Niño Outlook for the 2006/07 Winter”. These presentation slides and their abstracts are available at the TCC website (http://okdk.kishou.go.jp/library/jmspEAWM7.html)

3-3 Cooperative development of tailored climate products with TMD and MMD

Mr. Shotaro Tanaka, scientific officer of TCC, had meetings with the Thai Meteorological Department (TMD) and the Malaysian Meteorological Department (MMD) successively in March 2006. He met the officials engaging in agro-meteorology and climate services at TMD and MMD and showed the ongoing development and research about a surface climate database and a kind of tailored one-month prediction product for Southeastern Asia. He also met the potential users of seasonal prediction and searched their needs and requests. Both TMD and MMD showed interest in developing cooperatively such kind of tailored prediction products to meet the users' needs.

4. Climate data service activities in 2006

4-1 Provision of newly developed global datasets for climate system monitoring

The JMA's long-term historical Sea Surface Temperature analysis data (COBE-SST: see section 1-1 b) has been available since April 2006 from the TCC website (http://okdk.kishou.go.jp/ MRCS_SV12sstdata/aboutgpv_e.htm).

The JRA-25 data (see section 6-1) has been available since July 2006 at the JRA-25 official website (http://jra.kishou.go.jp/index_en. html). Online registration with agreement on our data policy is required to download the JRA-25 data.

5. Capacity building activities in 2006

5-1 JICA group training course in meteorology in 2006

JMA has conducted a training course in meteorology for developing countries every year since 1973 as one of the training courses provided by the Japan International Cooperation Agency (JICA), which is the Japanese official organization implementing international development assistance. In 2006, the course was held from 14 September to 16 December at the JMA headquarters and related institutions, attended by eight participants from Bangladesh, Costa Rica, Kenya, Malaysia, Nepal, Sri Lanka, Thailand and Uruguay. The course focuses on operational use of numerical weather prediction, satellite meteorology and climate information. During 11 days allocated for climate information, the trainees were given lectures on climate system monitoring, long-range forecasting, El Niño outlook and global warming projection. They practiced displaying and analyzing the GPV data, such as JRA data, seasonal ensemble prediction data and global warming projection data. Some famous climate scientists and experts were invited as lecturers from the Meteorological Research Institute, the National Institute for Environmental Studies, the University of Tokyo and the Japan Agency for Marine-Earth Science and Technology.

6. Outstanding research and development activities in 2006

6-1 Completion of JRA-25 Project

The JMA and CRIEPI[1]'s joint project on the long-term global atmospheric reanalysis, which is called "Japanese 25-year reanalysis (JRA-25)", was finalized in March 2006. The final products covering 26 years from 1979 to 2004 started to be provided in July 2006 to registered climate researchers and operational institutions (234 persons in 26 countries have registered as of the end of 2006) through the JRA-25 official website (http://jra.kishou.go.jp/index_en.html). It has already been shown through preliminary evaluation that the JRA-25 products have advantages over the existing reanalyses from the viewpoint of the reproducibility of tropical rainfall amount and the representation of tropical cyclones.

The near-real-time analysis by JCDAS from January 2005 to the present began to be provided through the JRA-25 official website in October 2006 to assist in monitoring and diagnosis of the current climate system.

6-2 Statistical analysis of the relationships between ENSO and global climate

ENSO events, both El Niño and La Niña, are considered as one of the most prominent phenomena which affect the climate over the globe. Since historical periods of El Niño and La Niña events were slightly changed due to the introduction of COBE-SST and the new index for El Niño and La Niña (see section 1-2), the statistical relationships were reexamined between El Niño / La Niña events and the climate over the world for the period from 1949 to 2004. Two kinds of maps, composite and schematic, were created. Composite maps show the tendencies of temperature (warm/cold) and precipitation (wet/dry) for each 5 degree by 5 degree grid, with marks indicating statistical significance levels of 90% or 95%. Schematic maps show the area with shading, where reliable tendency with the significance level of 90% or more is located over generally four or more adjacent grids. The detailed explanation of analysis procedure and the results are available from the TCC website (http://okdk.kishou.go.jp/products/climate/ENSO/index.html).

6-3 Statistical analysis of the relationships between tropical Pacific SST and global atmospheric circulation

ENSO events definitely affect the global atmospheric circulation through broadly changing rainfall pattern and intensity over the tropics. Owing to the new climatological data sets, COBE-SST and JRA-25 (see section 6-1), it became possible to do more reliable statistical analysis on the relationship between tropical Pacific SST indices and the atmospheric circulation over the globe than before when various data sources with different qualities were merged. Regression maps were derived based on the period from 1979 to 2004. The contours show the typical anomalous patterns in the atmospheric field when the SST index is equal to +1.0, and the shade indicates the area where the statistical confidence level by F-test is larger than 95%.

Considering that the atmospheric response associated with the ENSO is not simply linear with

[1] Central Research Institute for Electric Power Industry

respect to El Niño and La Niña phenomenon (Horeling et al., 2001), it seems that composite analysis for El Niño (La Niña) events are more appropriate. The reasons why we adopted regression maps rather than composite maps were; 1) the number of samples in 1979-2004 is too small, especially for La Niña events, to ensure statistical reliability, and 2) composite maps in El Niño and in La Niña events are almost the reverse with each other, so the regression maps when Niño.3 index is +1.0 (-1.0) can be roughly thought as the typical atmospheric response to El Niño (La Niña) events. Although the characteristics of regression patterns shown in this research are not much different in general from the previous ones, it is notable that the statistically significant areas further spread especially over the tropical region. The detailed explanation of the analysis procedure and the results are available from the TCC website (http://okdk.kishou.go.jp/products/clisys/REGR/index.html#sst).

6-4 Verification of the EPSs by long-term hindcast experiments

In order to verify the overall skill of the EPSs and to estimate the model's systematic errors for empirical calibration, long-term hindcast experiments were executed for both extended-range and long-range EPSs.

For the long-range EPS, 4-7-month integration was executed from the tenth of each month between January 1983 and December 2003. Each had 5 ensemble members. The experiment was verified according to the Standard Verification System for Long-Range Forecasts (SVSLRF: WMO 2002). The verification results are available from the TCC website (http://okdk.kishou.go.jp/products/model/hindcast/4mE/svs/index.html). The tercile probabilistic prediction products, which have been provided from the TCC website (http://okdk.kishou.go.jp/products/model/probfcst/4mE/index.html) since June 2005, were re-calibrated using the hindcast experiment and put into operation in March 2006.

For the extended-range EPS, 30-day integration was executed from the 10th, the 20th and the end of each month between January 1992 and December 2001. Each had 11 ensemble members. The hindcast experiment was used to make the new model's climatology and to develop a kind of tailored products for Asian countries (see section 6-8).

6-5 Development of an improved Ocean Data Assimilation System and El Niño prediction system

The Meteorological Research Institute (MRI) of JMA has been developing a new Ocean Data Assimilation System, named MOVE (Multivariate Ocean Variational Estimation) system, and an ocean prediction model, named MRI.COM (MRI Community Ocean Model), since 1999. They are planned to be incorporated into the new El Niño prediction system. In 2006, long-term reanalysis of ocean was executed using JRA-25 as the atmospheric boundary condition. Then the amounts of flux correction were estimated. With this flux correction, long-term hindcast experiment was executed by using the new El Niño prediction system and the prediction skill for the SST anomaly in the tropical Pacific was evaluated. It was shown that the prediction skill for the NINO.3 SST is better than the operational system, at least up to the 7 months leads, and for the western tropical Pacific SST, too.

6-6 Analysis about the structure and possible mechanisms of the summertime heat island phenomenon around the Tokyo metropolitan area

In 2005, JMA started publishing the annual report on the analysis and simulation results about the summertime heat island phenomenon in Kanto region, Tokyo metropolitan area. It was revealed from the model simulation that the most important factor contributing to the formation of the heat island in the daytime is the land use change, featuring the shrinkage of green space and the growth of artificial ground cover, and the factor contributing to that in the nighttime is the increase of architectural structures (urban canopy). The report for the summer 2005 was issued in Japanese on 31 March 2006. The outline of the report in English is available from the TCC website (http://okdk.kishou.go.jp/news/ topics_20060411.html).

6-7 Development of the integrated and quality-checked surface climate database for Asia-Pacific region

In order to develop a downscaling technique for one-month prediction, it is necessary to build a high-quality and long-term surface weather observation dataset at as many points as possible. TCC developed an integrated and quality-checked surface climate database for Asia-Pacific region, in cooperation with the FUJITSU FIP Corporation.

This database integrated the daily observation of temperature (maximum/mean/minimum) and precipitation from five data sources; APN (the Asia-Pacific Network for Global Change Research), ASEAN (the ASEAN Compendium for Climate Statistics projects), GAME (the GEWEX Asian Monsoon Experiment-tropics), GSN (the GCOS Surface Network) and SYNOP report received through GTS. After quality-checked by investigating internal consistency, temporal and spatial outliers, and by comparing with the independently reported monthly values, those data were merged into single integrated dataset. The dataset covers the period from 1 January 1961 to 31 December 2005, and the daily climatological normals were calculated for the base period from 1971 and 2000. The number of stations, where the daily climatological normal was available in the Southeast Asian region, was about 200 for temperature and 300 for precipitation, which is two to three times as many as the previous one.

This database was used in developing a statistical downscaling technique (see section 6-8), and will be used for upgrading weekly extreme climate monitoring in the region, too.

6-8 Development of the downscaled probabilistic one-month prediction products for Southeast Asian countries

In order to support the NMHSs in the Southeast Asian region in issuing probabilistic forecast information that is suitable to be incorporated into decision-making processes, TCC has developed downscaled probabilistic one-month prediction products for Southeast Asian countries since 2004, in cooperation with the FUJITSU FIP Corporation. In FY 2004, it was indicated that there is a possibility of making appropriate probabilistic forecasts of Week-2 and monthly mean temperature and accumulated precipitation from JMA's operational one-month EPS outputs from March 2001 to February 2004. In FY 2005, a statistical downscaling technique was developed and verified mainly for 7-day and 28-day precipitation amount using the high-quality and long-term daily surface climate database (see section 6-7) and the JRA-25 data. It was found that in general the multivariate regression using orographic predictor showed better skill, but the effect of the orographic predictor significantly differs from region to region and from season to season.

In FY 2006, based on the above mentioned findings, a prototype of the downscaled probabilistic products was developed, using the 10-year hindcast data (see section 6-4). Main target in this study is the probability of above--median for the first 14-day precipitation, and that of exceeding plus (minus) one standard deviation for the Week-2 temperature. In the statistical downscaling technique, the Madden Julian Oscillation (MJO) indices and the NINO.3 SST index were introduced as the candidate of predictors, besides the orographic predictor. It was found that these new indices, which represent the larger-scale features of tropical circulation field, tend to have positive impact on the skill of downscaling technique. The country-wise verification of the probabilistic prediction products showed significant positive Brier Skill Scores with high reliability, which meant better skill than the climatological prediction.

7. Action plans in 2007

7-1 Operational change

a) Introduction of new climatological normal derived from the JRA-25 for climate system monitoring (January 2007)

In January 2007, TCC is going to change the climatological normal used in the climate system monitoring and analysis to the one derived from the JRA-25 data (see section 6-1). In order to make the best use of the JRA-25 data, the base period for normal is planned to be changed to 1979-2004. Maps and GPVs of these new normals are just about to be provided as the Separated Volume of the Monthly Report on Climate System, No.13, which will be made available at the TCC website, too.

b) Upgrade of extended-range ensemble prediction system (March 2007)

The global atmospheric prediction model used in the extended-range EPS is scheduled to be upgraded in March 2007. Main points to be changed are as follows;

i) Update of absorption coefficient of water vapor in the solar radiation scheme, including the continuum absorption effect,

ii) Introduction of the new climatology of aerosol optical depth based on satellite observation data compiled by the Atmospheric Environment Division, JMA, and

iii) Introduction of the improved cumulus convection scheme, including trigger function and raindrop re-evaporation.

It has been shown that this new model, called GSM0703C, has smaller systematic errors, especially in the lower tropospheric temperature around Japan than the operational one.

Along with this model change, the Breeding of Growing Modes (BGM) method, which is used for making perturbed initial condition, will be improved. The new BGM method gives smaller initial perturbation than the current one in the tropics by properly taking into account instability associated with the Madden Julian Oscillation (MJO). Therefore, it is expected to improve the probabilistic forecasting skill of the MJO.

c) Upgrade of long-range ensemble prediction system (middle of 2007)

It is planned that the global atmospheric prediction model will be upgraded to the low resolution version of the GCM0703C, described in 7-1 b, and at the same time the number of ensemble members will be increased to 50 from 31 in the middle of 2007. In the new EPS, uncertainty in the prescribed SST will be considered in addition to uncertainty in the initial condition.

d) Change of TCC web server and renewal in TCC website including RA-II RCC homepage (second quarter of 2007)

The TCC web server will be renewed in April 2007. In the second quarter of 2007, website design will be renewed and the RA-II RCC Network homepage will be opened. It is planned to add some new products for monitoring, diagnosis and prediction of climate to the new website one after another (see section 7-1 e and section 7-3 a, b).

e) Experimental provision of downscaled probabilistic one-month prediction products through the TCC website (second quarter of 2007)

It is planned that the downscaled probabilistic one-month prediction products (see section 6-8) for Southeast Asian countries will be operationally produced and experimentally provided through the TCC website in the second quarter of 2007.

f) Start of issuance of the ‘Monthly Highlights on Climate System’ (April 2007)

‘Monthly Highlights on Climate System’ is available in April 2007 succeeding ‘Monthly Report on Climate System’. The report will be issued as a monthly bulletin in the PDF format focusing on monthly highlights of climate, atmospheric circulation and oceanographic condition. The report will have useful hyperlinks to the detailed information on climate monitoring and analysis in the TCC website. Around the same time, the historical maps on atmospheric circulation since 1979 and more useful climate diagnosis products are planned to be provided through the TCC website.

g) Start issuing the ‘Annual Report on Climate System’ (early 2008)

JMA has a plan to issue the ‘Annual Report on Climate System’ (provisional title) in early 2008. The report will include topics on the extreme climate events around the world as well as the summary of the climate system in the previous year.

h) Upgrade of Ocean Data Assimilation System (ODAS) and El Niño prediction system (March 2008)

The development of the new El Niño prediction system, including the MOVE and MRI.COM (see section 6-5), will reach its final phase for operational implementation. In 2007, a long-term hindcast experiment will be executed using the ocean-atmosphere coupled prediction system to verify the prediction skill of the atmosphere both in the tropics and in the mid-latitudes. It seems quite probable that the new El Niño prediction system has better skill than the current one, and it will be implemented into operation in March 2008.

7-2 Coordination activity

a) Organizing the international workshop on the “Applications of Advanced Climate Information in the Asia-Pacific Region” (February 2007)

JMA held an international workshop on the “Applications of Advanced Climate Information in the Asia-Pacific Region” on 20-22 February 2007 at the JMA HQ in Tokyo, under the auspices of the Ocean Policy Research Foundation, Japan. Main purposes of the workshop are;

i) to summarize the requirements of climate information users and to identify the prerequisite for the climate-related products suitable for the practical use in the sectors including agriculture, water resource, health and energy,

ii) to summarize the operational and development activities on the climate information and its applications in the Asia-Pacific nations, and

iii) to identify the requirements and capabilities for the research and development of the tailored climate information products which can contribute to the mitigation of climate-related hazards in various socio-economic sectors.

In the workshop, we plan to summarize the requirements for the regional climate centers.

b) Organizing the international conference on Reanalysis (January 2008)

The third WCRP international conference on reanalysis is planned to be held in January 2008 in Tokyo. Main purposes of the conference are;

i) to introduce completed available reanalysis and compare features of reanalysis data,

ii) to encourage use of reanalysis data for climate studies and extended applications,

iii) to understand data assimilation system,

iv) to discuss strategies of development and international cooperation for future reanalysis.

c) Participating in several international conferences and regional workshops

JMA is planning to participate in several international conferences and regional workshops on climate-related matters to promote international and regional cooperation. Major events already fixed are;

i) WMO CLIPS focal point training workshop for RA-II (eastern part) (Thailand, January),

ii) WMO conference - Social and Economic Benefits of Weather, Climate and Water Services - (Spain, March),

iii) Climate Prediction Applications Science Workshop 2007 (USA, March), and

iv) Third session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Asia (China, April).

d) Cooperative development of tailored climate products with TMD and MMD

TCC will continue to assist TMD and MMD in developing tailored climate prediction products and advancing their application in various socio-economic sectors, through the experimental provision of the downscaled probabilistic forecast and collaborative evaluation of the forecast considering practical use. Additionally, through every opportunity TCC will introduce the both and other NMHSs to knowledge and experience related to the application that has been acquired in Japan: for example, how to establish relationships with user organizations and to conduct collaborative research on climate information application.

e) Support coordination for the ASEAN climate data application workshop

TCC is planning to support the climate data application workshop organized by the ASEAN sub-committee on meteorology and geophysics, if Japan is approved as a dialogue partner.

7-3 Data service

a) Monthly surface climate database service (second half of 2007)

As a new product of TCC's global climate monitoring, global surface climate database such as monthly mean temperature at stations in the world will be made available on the TCC website. The monthly climate data are decoded from CLIMAT messages sent by each NMHSs. Users will be able to obtain current climatic data not only in the previous month, but also in past months since 1982 through an interactive web page with a simple operation.

b) Data service for the global climate change monitoring (autumn 2007)

In order to support the monitoring of regional climate changes in various regions, TCC is planning to provide long-term surface temperature analysis data over the globe on the 5x5 degree grids as monthly maps and GPVs through the TCC website. This service will start in autumn 2007.

c) Provision of Technical document about how to check the quality of climate data (January 2007)

TCC developed a technical document about how to check the quality of daily climate data, which was used in the course of developing the integrated climate database (see section 6-7). This document is going to be provided to the partner institutions, such as TMD and MMD.

7-4 Training and capacity building

a) JICA group training course in meteorology (Sep-Dec 2007)

Almost the same group training course as in 2006 is going to be organized by the Japan International Cooperation Agency (JICA), and CPD/TCC will deliver lectures on climate system monitoring, long-rang forecast, El Niño outlook and global warming projection and provide practices on displaying and analyzing the GPV data (see section 5-1).

b) Technical transfer of downscaling technique to TMD and MMD (January 2007)

A staff member of TCC and an engineer of the FUJITSU FIP Corporation are going to visit TMD and MMD to make a technical transfer of the downscaling technique developed in 2006.

7-5 Research and development activity

a) Development of the web-based analysis and diagnosis tools of extreme climate events

In order to facilitate the analysis and diagnosis of unusual climate events and to study climate variability and change exploiting the JRA-25 and JCDAS data, TCC is going to develop a web-based interactive analysis and diagnosis tool. At the first step, the system will be served to the climate scientists in Japan, and then it will be opened to the NMHSs' users after improvement and enhancement.

b) Analysis about the structure and possible mechanisms of the summertime heat island phenomenon in Kinki district, Japan

Kinki district, containing mega-cities such as Osaka, Kobe and Kyoto, is famous for extremely hot weather in summer. The analysis about the structure and possible mechanisms of this extremely hot weather is being executed by the urban model simulation experiment, including the anthropogenic heat release data developed in the Osaka University. A report will be issued in March 2007.

c) Provision of risk maps on extreme events in Japan (March 2007)

As the first step to the risk map for extreme climate events under the future progression of global warming, the return periods of extremely heavy rainfall were calculated at 51 stations in Japan, where more than 100-year homogeneous observation data are available. The product will be distributed to the related organizations which are responsible for disaster prevention and mitigation in March 2007.

d) Experimental provision of "Early Warning for Unusual High/Low Temperature" in Japan (March 2007)

Early warning information for unusual climate events has been requested by the climate-sensitive sectors, like agriculture and energy. The one-month EPS is thought to be able to predict the probability of occurrence of unusual high/low 7-day mean temperature events, which are defined as the events with less than 10% probability of occurrence climatologically, with one to two weeks lead time. In 2006, a post-processing procedure of the EPS outputs to the excess/non-excess probability was developed and evaluated. Then the threshold of the probability for issuing the "early warning" was determined as 30%. After constructing the web-based dissemination system of the "early warning" and the basic probability prediction products, JMA will issue the information to the specific users in agriculture and energy sectors on an experimental basis in March 2007 for examining the contents, timeliness and the thresholds of the information.

e) Publication of Global warming projection vol.7 (March 2008)

A regional coupled ocean-atmosphere model was developed in MRI of JMA and is being used for the projection of the atmospheric and oceanic climate around Japan in the end of this century. The improved version of the global coupled ocean-atmosphere model, named MRI-CGCM2.3, is executed to serve the boundary condition to the regional model. JMA plans to publish the "Global Warming Projection Volume 7" in March 2008, which describes global/regional features of the projected climate change and that of regional ocean currents.