Tokyo Climate Center, Japan Meteorological Agency

TCC News

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Contents

El Niño Outlook (April 2006 - October 2006)

The NINO.3 SST is likely to be close to normal during the latter half of spring and this summer, and be around normal until mid-autumn in 2006. The current La Niña event is likely to dissipate during the prediction period.

In March 2006, negative SST anomalies were widely found in the central and eastern equatorial Pacific (Figure 1). The SST deviation from the sliding 30-year mean SST averaged over the NINO.3 region was -0.8°C for March 2006, and its five-month running mean values have consecutively exceeded -0.5°C from October in 2005 to January in 2006. In the subsurface ocean temperature, positive-in-west and negative-in-east pattern, as have been found since January, were found during March (Figure 2). The convective activities over the western equatorial Pacific were above normal, and at the lower level of troposphere, easterly wind anomalies continued over the central and western equatorial Pacific during March (Figure 3). Current atmospheric and oceanic conditions in the equatorial Pacific are consistent with those during La Niña events.

In accordance with the eastward movements of the negative subsurface temperature anomalies in the eastern equatorial Pacific, it is likely that warm waters in the western equatorial Pacific start to migrate eastward. On the other hand, easterly wind anomalies were predominant around the dateline during late March, and those lead to the considerations that it is unlikely to result in the rapid increase of the SST anomalies in the central and eastern parts.

The JMA's El Niño forecast model predicts that the NINO.3 SST will be close to normal during spring and summer, and be above normal afterwards (Figure 4). Taking into consideration, however, that the model tends to be biased toward positive in the latter half of prediction period under such conditions that warm waters are accumulated in the western equatorial Pacific, it is expected that the NINO.3 SST will be slightly lower than the model prediction.

Judging from all the above, NINO.3 SST is likely to be close to normal during the latter half of spring and this summer, and be around normal until mid-autumn in 2006. The current La Niña event is likely to dissipate during the prediction period.

(*Yoshinori Oikawa, Climate Prediction Division*)

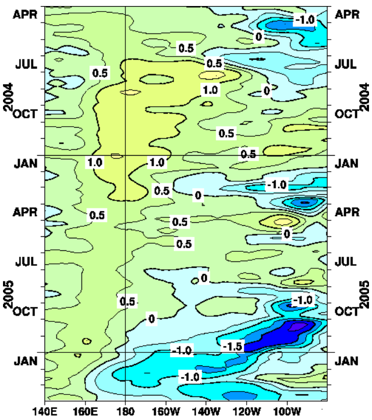

Figure 1 Time-longitude cross section of SST anomalies along the equator in the Pacific Ocean for March 2006
Base period for normal is 1971-2000.

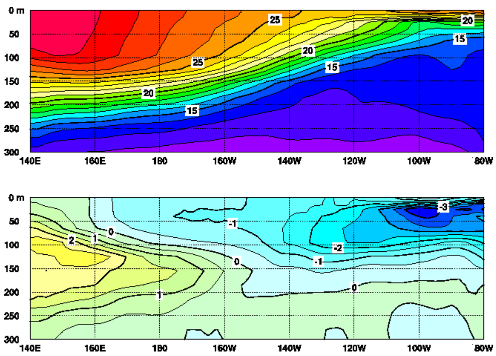

Figure 2 Depth-longitude cross sections of temperatures (upper) and anomalies (lower) along the equator in the Pacific Ocean for March 2006
Base period for normal is 1987-2005.

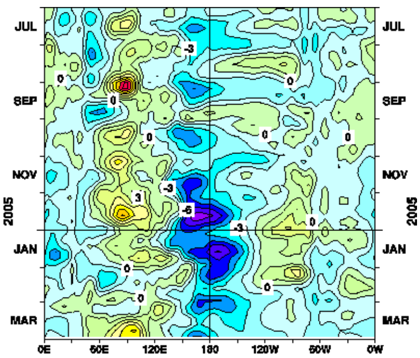

Figure 3 Zonal wind anomalies at 850 hPa along the equator for March 2006.
Base period for normal is 1979-1993.

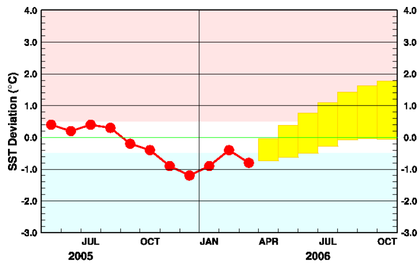

Figure 4 SST deviation outlook for the NINO.3 region by JMA's El Niño forecast model
The red line with closed circles shows the observed SST deviation, and the yellow boxes show the predicted SST deviation for the next seven months. Each box denotes the range of 70 % confidence.

JMA's seasonal numerical ensemble prediction for 2006 summer

In 2006 summer, slightly active Asian monsoon except for the western North Pacific region is predicted by JMA's seasonal numerical ensemble prediction system, but it is noted that the skill of Asian monsoon prediction is not so high that the results should be interpreted with caution.

1. Introduction

In this report, JMA's seasonal numerical ensemble prediction for 2006 summer (JJA), which was used for one of prognostic tools for the JMA's operational warm season outlook issued on 25th April 2006, is introduced. The prediction consists of 31 ensemble members of which initial date is 17th April 2006. Details on the prediction system and verification maps based on 21-year hindcasts are available at http://okdk.kishou.go.jp/products/model/index.html.

The two-tiered method is adopted in the prediction system. So, firstly predicted SST anomalies are explained in the report, and secondly predicted circulation fields in the tropics and sub-tropics are described associated with the predicted SST anomalies. Finally, predicted circulation fields in the middle and high latitudes in the Northern Hemisphere are described.

2. SST anomalies (Figure 5)

During 2006 summer, the SST anomalies are predicted to be slightly above normal except the following areas: the equatorial eastern Pacific, the southern Indian Ocean, and the Antarctic Ocean, where they are predicted to be slightly below normal. As mentioned in the previous article in this issue, it is likely that the current La Niña event lapse during the latter half of the spring and the summer, but La-Niña-like conditions persist in the predicted SST anomalies in JJA.

3. Circulation fields in the tropics and sub-tropics (Figure 6)

As expected from the predicted SST anomalies, below normal precipitation is predicted in the equatorial eastern Pacific and above normal precipitation is predicted in the Maritime continent and the tropical Indian Ocean. Although predicted precipitation amount is, on the whole, slightly above normal in the Asian monsoon region, that is slightly below normal in the western North Pacific monsoon region. Consistent with the precipitation pattern, the upper tropospheric velocity potential anomalies are negative (more divergent) over the Indian Ocean and positive (more convergent) over the tropical Pacific, and also, anomalous large scale divergence flow is predicted near Central America and over the tropical North Atlantic.

Corresponding to these anomalous divergent flows, characteristic rotational flow anomalies are predicted such as 1) northwestward extension of the Tibetan High in the upper troposphere, 2) westward extension of the North Pacific Subtropical High in the lower troposphere.

Though positive precipitation anomalies are seen over the maritime continent and over the tropical Indian Ocean, the forecasting skills for the precipitation are generally so low in those areas that the results and corresponding predicted circulation anomalies should be interpreted with caution.

4. Circulation fields in the middle and high latitudes (Figure 7, Figure 8, Figure 9)

The ensemble prediction says that the summer mean 500-hPa height anomalies will be above normal over most parts of the Northern Hemisphere, except for the arctic region and the high latitudes such as northern Europe and northwestern part of North America. This predicted large scale anomaly pattern is similar in most parts to the one of the leading modes of the low frequency

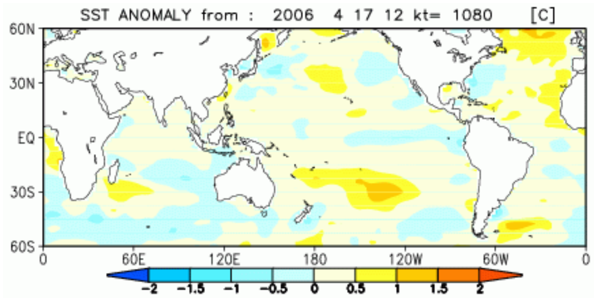

Figure 5 Predicted SST anomalies for 2006 JJA

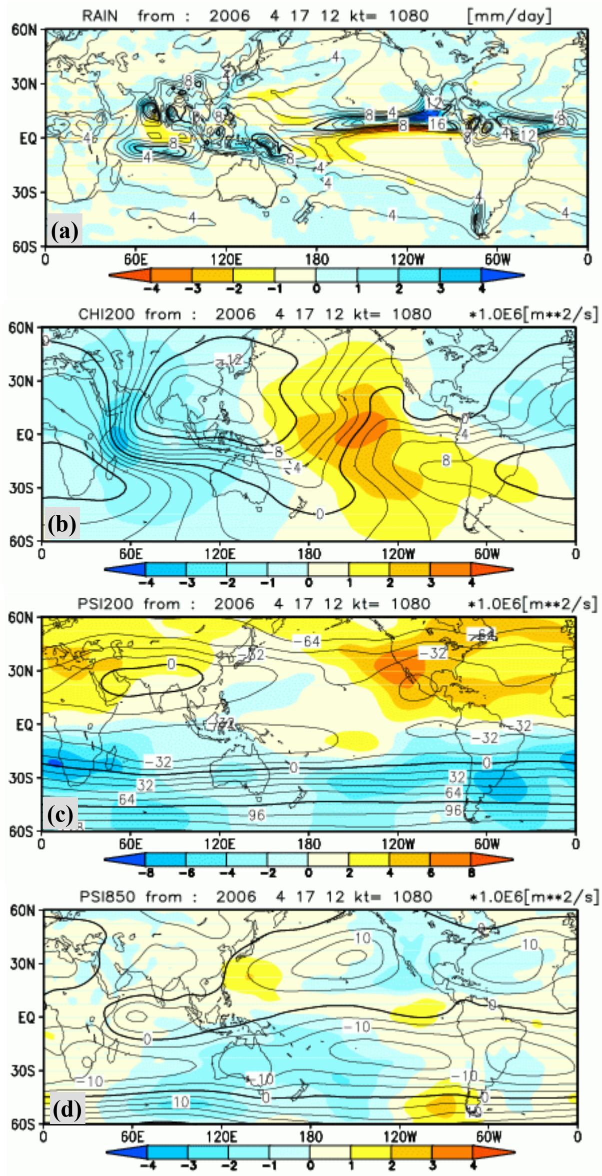

Figure 6 Predicted atmospheric fields for 2006 JJA (Ensemble mean of 31 members)

(a) Precipitation (contour) and anomaly (shading). Contour interval is 2 mm/day,

(b) Velocity potential at 200 hPa (contour) and anomaly (shading). Contour interval is 2×10^6 m^2/s,

(c) Stream function at 200 hPa (contour) and anomaly (shading). Contour interval is 16×10^6 m^2/s,

(d) Stream function at 850 hPa (contour) and anomaly (shading). Contour interval is 5×10^6 m^2/s.

variability of the atmosphere in the Northern Hemisphere: EOF2 of 500hPa height anomalies in JJA which could be called the Arctic Oscillation (AO) in summer. The probabilistic distribution of EOF2 score predicted by each member is positively biased, and the ensemble average of predicted EOF2 scores is about 0.8: positive phase of the AO is predicted with high probability. The probabilistic distribution of the Okhotsk high index, which is defined by area averaged 500hPa height anomalies in the East Asian high latitudes (130°E-150°E, 50°N-60°N), is also positively biased. This suggests that the Okhotsk high will be more active than normal .

(*Shuhei Maeda, Climate Prediction Division*)

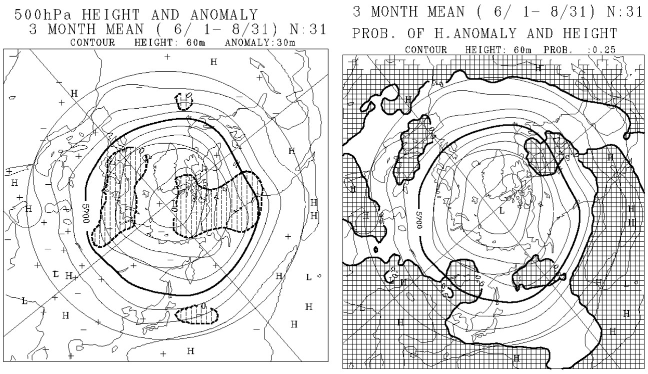

Figure 7 Predicted 500 hPa height in the Northern Hemisphere for 2006 JJA
(a) Ensemble mean (solid contours; interval is 60 m) and anomaly (dashed contours; interval is 30 m). Negative anomalies are shaded.
(b) Ensemble mean (solid contours; interval is 60 m) and the probabilities of anomalies predicted to be above {+0.42×standard deviation} or below {–0.42×standard deviation}. Areas where probabilities exceed 50 % are hatched. Areas above {+0.42×standard deviation} are cross hatched, and areas below {-0.42×standard deviation} are single hatched.

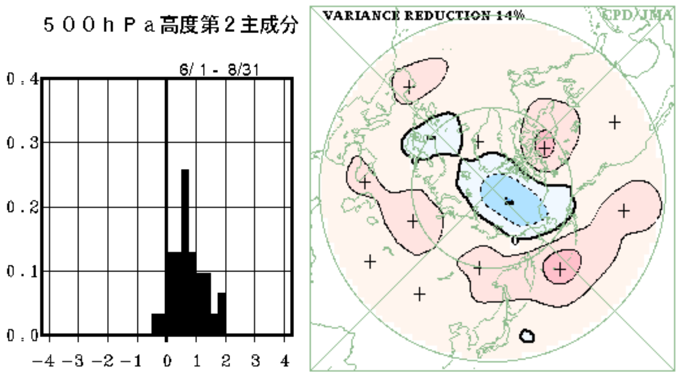

Figure 8 Histogram of predicted (2006 JJA) EOF2 scores (left) defined by the second EOF of 500 hPa height anomalies in the Northern Hemisphere (right)

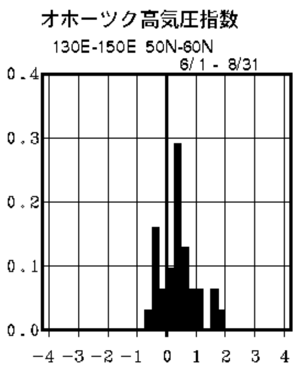

Figure 9 Histogram of predicted (2006 JJA) Okhotsk high indices defined by area averaged 500 hPa height anomalies in the East Asian high latitudes (130E-150E, 50N-60N)

Verification results and probabilistic prediction products of the new JMA's seasonal Ensemble Prediction System

As introduced in the TCC News No.3, JMA's seasonal Ensemble Prediction System (EPS) was upgraded in March 2006. In advance of the upgrade, 21-year hindcast (1983-2003) of the new system was carried out in order to check the forecasting skills of the new system and to provide the relevant information for postprocessing the EPS outputs, including correction of model bias. The verification results of the hindcast and the probabilistic prediction products using the MOS technique (see the TCC News No.2) are now available on the TCC web site. The verification was conducted along the WMO Standard Verification System for Long-Range Forecast (SVSLRF). Besides, registered users can download the GPV of the hindcast. Please visit our verification page and check the skills before using our prediction products.

(*Shuhei Maeda, Climate Prediction Division*)

Summary of Asian Winter Monsoon 2005/2006

In the former half of the season, the winter monsoon was predominant and cold surges frequently occurred over East Asia, which led to severe damage, especially over 100 fatalities due to heavy snowfalls in Japan.

1. Extreme Climate Events

(1) Cold wave and heavy snow in East Asia (December)

In December, extremely low temperatures were observed from southern Central Siberia to Japan due to persistent cold-air flow from the Arctic. Record-breaking heavy snowfalls were also observed in the Japan Sea Side of Japan. In Japan, more than 80 persons died during December, the total number of the deaths reached 150 due to the heavy snowfalls in this winter. In northeastern China and Korea, it was also reported that heavy snow disrupted transportation such as airplanes and trains.

(2) Landslide in the Philippines (February)

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 precipitation was observed in five days (Figure 10). It is considered that this heavy rain was caused by the sustained active convection due to the confluence of strong trade wind and cold surge from the Eurasia continent and to geographical features (Figure 11).

(3) Drought in southern China

Since last autumn, southern China has experienced dry condition. In February, the shortages of drinking water for over 300,000 people in Beihai were reported. In Beihai, precipitation amounts from October 2005 to February 2006 were about 80 mm, which is about one thirds compared to the normal. Over 30 mm out of the five-month total precipitation, 80 mm, fell in the last three days of February.

2. Atmospheric circulation

The features of atmospheric circulation and surface climate were very different between in the former and in the latter half of Asian winter monsoon season during 2005-2006 (Figure 12, Figure 13 and Figure 14). In the former of the season, northeastern Asian winter monsoon pattern was highly dominant, that is to say, both Siberian High and Aleutian Low were very strong (Figure 13). Cold surges frequently occurred, and reached over the South China Sea and the Philippine Sea. Convection was remarkably active from the Bay of Bengal to the Philippine Sea (Figure 14). Maeda (2005) suggested that these features were caused by predominant negative phase of the AO (Arctic Oscillation) and enhanced by the stationary Rossby wave train trapped in the Asian jet. It was suggested that there might be some interaction between the tropics and extra-tropics, but it needs further examination (http://okdk.kishou.go.jp/news/topics_20060127.html). In the latter half of the season, both Siberian High and Aleutian Low became weak (Figure 13). As a result cold surges didn't frequently take place in eastern Asia south of western Japan (Figure 14).

(1: Ayako Takeuchi and 2: Yayoi Harada, Climate Prediction Division)

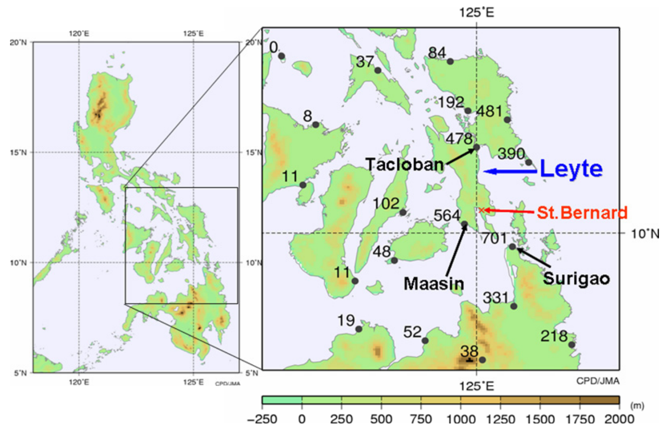

Figure 10 Total precipitation for 8-12 Feb. 2006 around the Leyte island
The numbers in the upper left of the circles denote precipitation (unit: mm). The circles show observatories. There is no observatory on St. Bernard, where a landslide occurred.

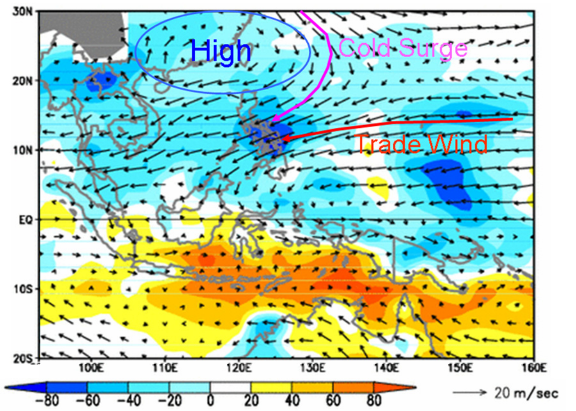

Figure 11 OLR anomalies and 850hPa winds averaged for 8-12 Feb. 2006
The shades show OLR anomalies and the arrows show 850 hPa winds. The blue (red) shades denote areas where the convective activities were stronger (weaker) than normal.

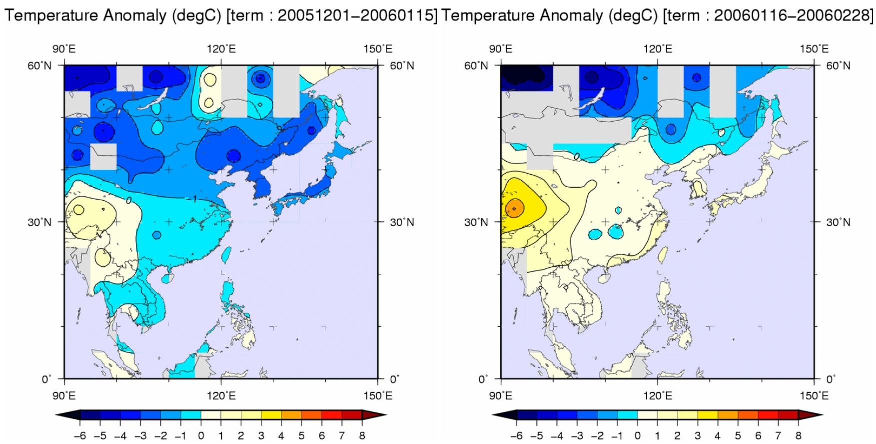

Figure 12 Surface temperature anomalies in the former (left panel) and latter (right panel) half of 2005/6 Asian winter monsoon season.
Original data are the daily temperature of SYNOP reports. The periods for average in left and right panels are 1 Dec. 2005 – 15 Jan. 2006 and 16 Jan. 2006 – 28 Feb. 2006, respectively.

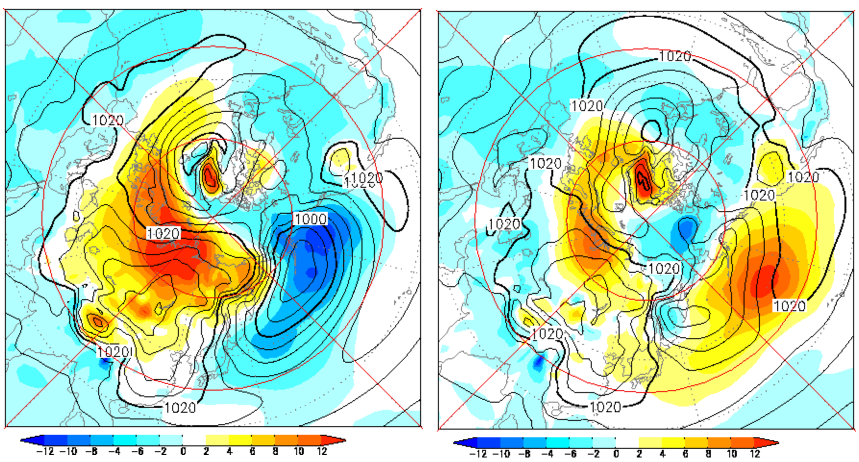

Figure 13 Sea level pressure and anomalies in the former (left panel) and latter (right panel) half of 2005/6 Asian winter monsoon season.
The contours show historical values and the shades show anomalies. The periods for average are the same as in Figure 12.

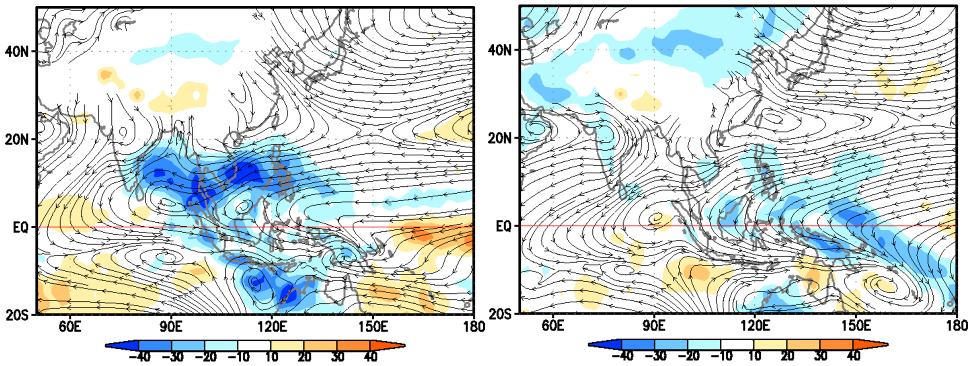

Figure 14 Wind at 850 hPa and OLR anomalies in the former (left panel) and latter (right panel) half of 2005/6 Asian winter monsoon season.
The stream lines show historical winds and the shades show OLR anomalies. The periods for average are the same as in Figure 12.

Stratospheric major warming event in January 2006

A remarkable sudden warming event took place in January 2006. The event was identified as "Major warming". Since the warming occurred, the state that the temperature was above normal had persisted until the middle of February.

Climate Prediction Division, JMA, has routinely monitored the stratospheric circulation, focusing on Stratospheric Sudden Warming (SSW) events, and issued a STRATALERT report everyday during the occurrence of a SSW (http://okdk.kishou.go.jp/products/clisys/index.html#STRAT).

Figure 15 shows time sequence of 30hPa temperature over the North Pole. The warming started in the beginning of January 2006 (identified as "Minor"). Before the temperature returned to its normal, an additional warming event occurred in the end of the month (identified as "Major"). The temperature reached to -30 ℃, 40 ℃ higher than its normal. At that time, meridional temperature gradient in the zonal mean field was reversed, and corresponding to it, easterly winds appeared north of 60°N. Such a strong warming event is rare in January and has occurred the first time since 1995. Those conditions had persisted until the middle of February. At the time of the occurring of the major warming, developed ridge over central Siberia was remarkable at 30 hPa. It was analyzed that vertical and horizontal energy propagation of planetary-scale waves from the troposphere to the stratosphere played an important role in the major warming.

The details of the analysis are available at http://okdk.kishou.go.jp/news/topics_20060425.html

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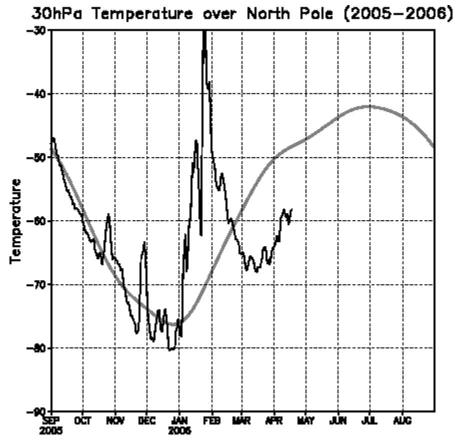

Figure 15 Time sequence of temperature (℃) at 30 hPa over the North Pole in 2005/2006
Black line shows the temperature from September 2005 to April 2006. Gray line shows its climatology.

TCC's Research and Development Activity -Development of a Downscaled Probabilistic One-month Forecast-

As TCC's research and development activity, TCC started conducting a three-year research project in 2004, in cooperation with the FUJITSU FIP Corporation, on the development of detailed probabilistic one-month forecasts in Southeast Asia which are expected to be incorporated into decision-making processes in a variety of socio-economic sectors.

1. Purpose of this research

The main three objectives of this research project are as follows:

1) development of the technique deriving appropriate probabilistic forecasts from JMA's one-month Ensemble Prediction System (EPS) products;
2) development of the statistical downscaling technique for observation-point forecasts in Southeast Asia from global prediction model outputs; and
3) research on effective ways to use detailed probabilistic forecast based on the techniques developed in the above 1) and 2) in socio-economic activities.

2. Achievements in 2005

In the second year of this project, 2005, three research objectives were set in accordance with the first year's recommendations: 1) to construct a longer-term and higher-quality surface climate database in the Southeast Asian region; 2) to improve the statistical downscaling technique, especially for precipitation forecasts; and 3) to search the best use of the point-wise probabilistic forecasts and its applications through communication and cooperation with the producers and users of climate prediction information in the Southeast Asian countries.

(1) Construction of a surface climate database

A longer-term and higher-quality surface climate database of daily maximum/mean/minimum temperature and daily precipitation compared with the existing climate dataset was successfully constructed for the Southeast Asia region. The number of the observatories, where we could estimate the daily normal, was over 200 for temperature and 300 for precipitation about three times as many as the existing one. These new daily surface climate data are quite useful not only for developing and verifying the point-wise probabilistic forecast, but also for monitoring and assessing the abnormal climate condition in Southeast Asia operationally at JMA on a daily basis.

(2) Improvement of the statistical downscaling technique

The statistical relationships were examined for the monthly mean precipitation at each month and observatory. It was found that the effect of the orographical predictor was quite different from place to place and season to season. Four classifications seemed possible: 1) where the JRA-25 precipitations reproduce the observed precipitation well without any calibrations, such as the eastern part of the Philippines in wintertime, 2) where the JRA-25 precipitations correlates well with the observed precipitation and the orographic effect is not so important, such as the western part of the Malay Peninsula in wintertime, 3) where the orographic predictor significantly improves the estimation, such as the western part of Thailand, and 4) where the orographic effect is not enough to reproduce the observed variability of precipitation, such as the inland area of Indochina Peninsula in summertime. Figure 16 shows some of the results. The relationships were examined for the weekly precipitation of each month, too, and almost the same results came out, though the orographical effect seemed a little smaller than the monthly cases. This research gave us valuable information on the characteristics of the JRA-25 precipitation in the tropics, too.

(3) Research on the possible field for climate forecast application

TCC visited Thai Meteorological Department (TMD) and Malaysia Meteorological Service (MMS) in March 2006. It was quite informative for us to visit and talk with the direct users of TCC's products. TCC and both TMD and MMS could understand the each other's current status of climate related services and agreed to promote the cooperative and collaborative relationships to develop advanced climate information applications. It was identified that agriculture is the top priority field for advancing climate application and the detailed and precise forecast of precipitation are primarily required. It was recognized that we would promote direct communication with the end-users of our climate information.

3. Plans on research in 2006

In the last year of this project, 2006, three research objectives were set in accordance with the second year's recommendations: 1) to develop and evaluate the MOS-type statistical downscaling technique, especially for precipitation forecasts in the Southeast Asia region using the 20-year hindcast data; 2) to develop and evaluate the point-wise probabilistic forecast using the 20-year hindcast data; and 3) to provide the above prototype products to TMD and MMS for evaluation of their practical utility for the development of tailored information for specific users.

The details of this research are described in http://okdk.kishou.go.jp/about/TCC_research_and_development_2006.pdf

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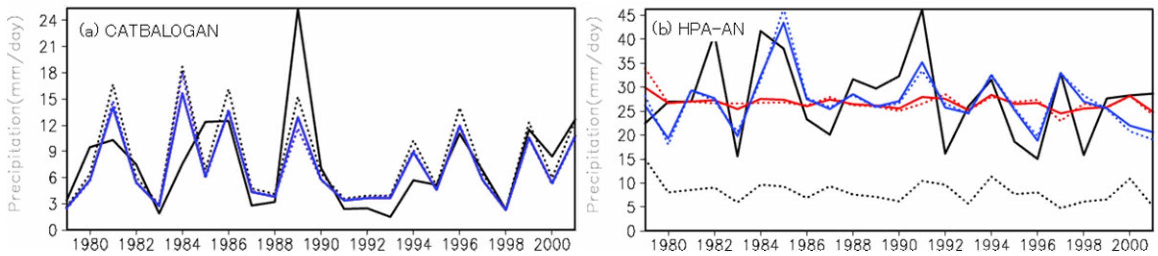

Figure 16 Time series of monthly mean precipitation (mm/day)

Left and right panels show Catbalogan, the Philippines, in January and Hpa-an, Myanmar, in June, respectively. In both panels, solid and dot black lines show precipitation of observation and of JRA-25, respectively. In left panel, blue line indicates the precipitation estimated from single regression on JRA-25 precipitation. In right panel, red and blue lines indicate the precipitation estimated from single regression on JRA-25 precipitation and from multiple one on JRA-25 precipitation and wind multiplied by the slop of terrain, respectively.

TCC having announced its implementation plan of the RCC functions in WMO RA II

TCC is preparing for playing an integral part of the Regional Climate Center (RCC) Network of WMO Regional Association (RA) II and has announced its implementation plan (http://okdk.kishou.go.jp/about/implementation_plan_2006.pdf) of RCC functions including current status and future plan of climate-related services in JMA.

It was decided in the 13th Session of WMO RA II, held in Hong-Kong during 7-15 December 2004, that the RCC Network consists of multiple multifunctional centers and has five key functions: that is, operation, coordination, data services, training and capacity building, and research and development functions. According to the Designation Procedures for RCC Network in RA II, the RCC Network is planned to start its operation on a pilot basis in May 2006.

TCC has been conducting a variety of activities for assisting NMHSs in the Asia-Pacific region in climate-related services since when it was established, April 2002. TCC is willing to further execute its tasks and RCC functions, especially through collaborative research and development activities (see the previous article), which aim to advance the utilities of climate information and prediction in various socio-economic sectors for mitigating climate-related disasters and adopting climate variability and change.

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Any comments or inquiries on this newsletter and/or the TCC website would be much appreciated. Please e-mail to the following address:
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