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El Niño Outlook (April - October 2007)

The NINO.3 SST is likely to be below normal from spring to summer and the negative SST anomalies are likely to persist or strengthen from summer to autumn. It is likely that the ocean and atmosphere in the equatorial Pacific will become a La Niña condition within one or two months.

In March 2007, SST averaged over the NINO.3 region was -0.5°C deviated from the latest 30-year sliding mean and five-month running mean NINO.3 SST deviation was $+0.5^{\circ}\text{C}$ in January 2007. SSTs were below normal in the eastern part of the equatorial Pacific and above normal in the western part in March (Figure 1). Subsurface negative temperature anomalies were prominent from the central to eastern parts in March (Figure 2). Convective activities around the date line were below normal. In the central part, winds at the upper troposphere were close to normal, while easterly wind anomalies were found at the lower troposphere.

The above oceanic and atmospheric conditions indicate a La Niña event. The negative SST anomalies from the central to eastern equatorial Pacific are considered to persist or strengthen in the months ahead.

JMA's El Niño forecast model predicts that the NINO.3 SST will be below normal from spring to summer, and around 1°C below normal from summer to autumn (Figure 3).

Considering all the above, the NINO.3 SST is likely to be below normal from spring to summer and negative SST anomalies are likely to persist or strengthen from summer to autumn. It is likely that the ocean and atmosphere in the equatorial Pacific will become a La Niña condition within one or two months.

(Ikuo Yoshikawa, Climate Prediction Division)

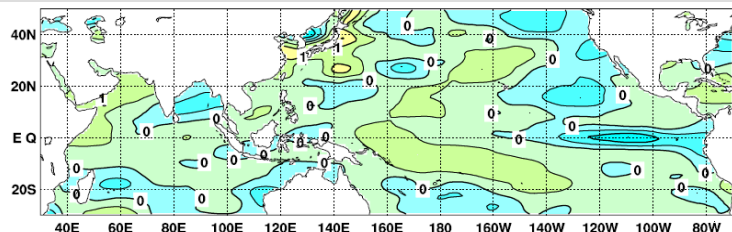


Figure 1 Monthly mean SST anomalies in the Pacific and Indian Oceans for March 2007
Contour interval is 0.5°C . Base period for normal is 1971-2000.

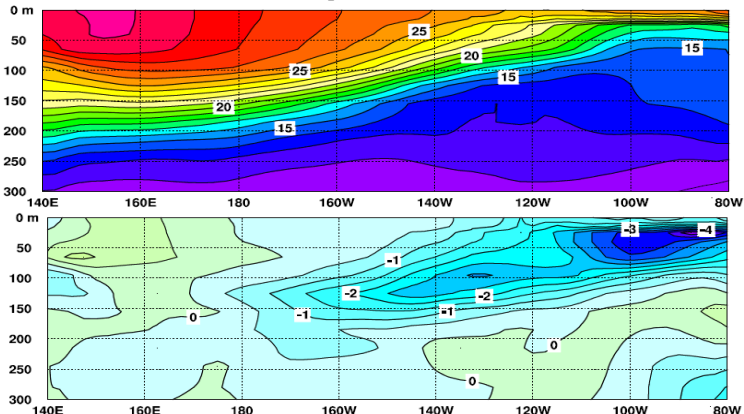


Figure 2 Depth-longitude cross sections of temperature (upper) and anomalies (lower) along the equator in the Pacific Ocean for March 2007
Base period for normal is 1987-2006.

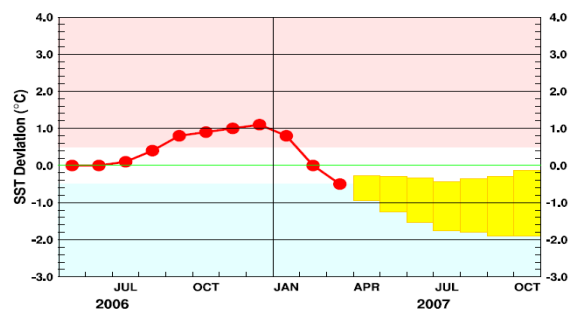


Figure 3 Outlook of the SST deviation for NINO.3 by the El Niño forecast model

This figure indicates a time series of monthly SST deviations for NINO.3 (5°N - 5°S , 150°W - 90°W). Thick line with closed circles shows observed SST deviations and boxes show predictions by the El Niño forecast model for the next six months. Each box denotes the range of SST deviation with the probability of 70%.

JMA's Seasonal Numerical Ensemble Prediction for 2007 Summer

In 2007 summer, slightly inactive Asian monsoon is predicted, except for the western North Pacific region, by JMA's seasonal numerical ensemble prediction system. It should be noted that the results should be interpreted with caution due to insufficient skills for Asian monsoon prediction.

1. Introduction

This report introduces JMA's seasonal numerical ensemble prediction for 2007 summer (JJA), which was used as a prognostic tool for JMA's operational warm season outlook issued on 25 April 2007, predicted with an initial date of 17 April 2007. The prediction consists of 31 ensemble members and employs the two-tier method: first, global SSTs are predicted using a combination of persisted anomalies, climatology and prediction with JMA's El Niño prediction model (atmosphere-ocean coupled model; CGCM), and then the specific SSTs are fed into the atmospheric model (AGCM). Details on the prediction system and verification maps based on 21-year hindcast experiments are available at <http://ds.data.jma.go.jp/tcc/tcc/products/model/index.html>. In the report, predicted global SST anomalies are presented in section 2. Then, the predicted circulation fields in the tropics and sub-tropics associated with these SST anomalies are described in section 3. Finally, the predicted circulation fields in the middle and high latitudes in the Northern Hemisphere are explained in section 4.

2. SST anomalies (Figure 4)

During 2007 summer, SSTs in the equatorial Pacific are predicted to be slightly above normal in the western part and negative anomalies exceeding -0.5°C in the central and eastern parts. This anomaly pattern is similar to the one typically observed during La Niña events. In the Indian Ocean, SSTs are predicted slightly above normal, except for the Bay of Bengal, where relatively negative anomalies are seen. Positive SST anomalies are predicted in the Atlantic.

3. Circulation fields in the tropics and sub-tropics (Figure 5)

As expected from the predicted SST anomalies, below normal precipitation is predicted in the equatorial central and eastern Pacific and the Bay of Bengal, while above normal precipitation is predicted in the Maritime continent and the Atlantic. Above normal precipitation is also seen in the west coast of Mexico, which is related with the positive SST anomalies there. The negative SST anomalies in the eastern part of the Pacific may further boost the positive SST anomalies. Predicted precipitation amount is slightly below normal in the Asian monsoon region on the whole, but slightly above normal amount is predicted for the western North Pacific.

Upper tropospheric velocity potential anomalies are negative (more divergent) over the Maritime Continent and the Atlantic, which is consistent with the precipitation pattern. Positive (more convergent) anomalies are predicted over the tropical central and eastern Pacific and the Bay of Bengal, but those anomalies over the Bay of Bengal are small.

Corresponding to the positive anomalies of velocity potential over the eastern Pacific, characteristic anomalies of stream function are predicted over North America in the sub-tropics, such as positive (negative) anomalies at the upper (lower) troposphere. Negative anomalies of velocity potential are predicted over the Maritime Continent, but the anomalies of stream function are relatively small.

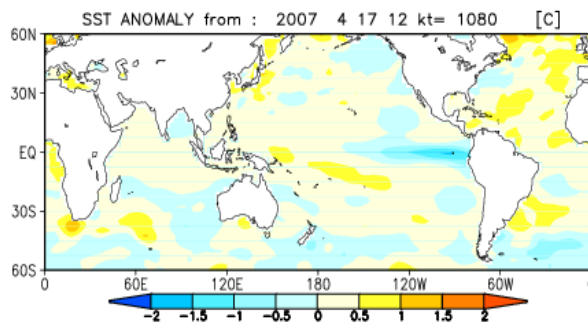


Figure 4 Predicted SST anomalies for 2007 JJA

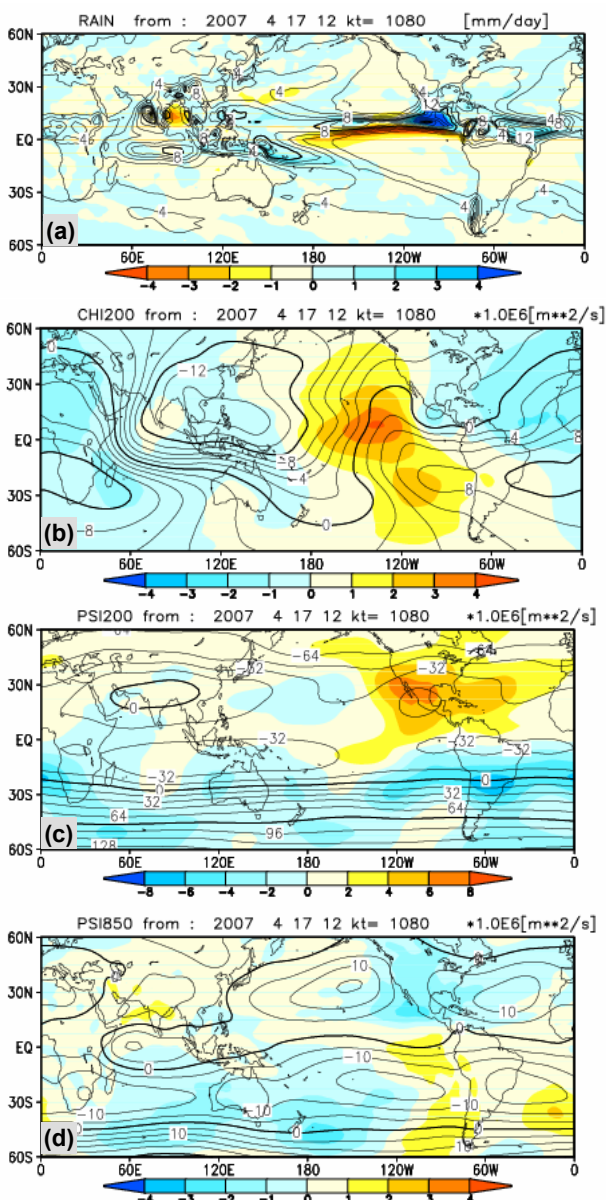


Figure 5 Predicted atmospheric fields for 2007 JJA (Ensemble mean of 31 members)

- (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 $2 \times 10^6 \text{ m}^2/\text{s}$,
- (c) Stream function at 200 hPa (contour) and anomaly (shading). Contour interval is $16 \times 10^6 \text{ m}^2/\text{s}$,
- (d) Stream function at 850 hPa (contour) and anomaly (shading). Contour interval is $5 \times 10^6 \text{ m}^2/\text{s}$.

4. Circulation fields in the middle and high latitudes in the Northern Hemisphere (Figures 6 and 7)

The ensemble prediction indicates that seasonal mean 500-hPa height anomalies for 2007 summer is above normal over most parts of the Northern Hemisphere, except for high latitudes such as the northern Atlantic and the northwestern part of North America. This large scale positive anomaly might be explained by the leading modes of low frequency atmospheric variability in the Northern Hemisphere, i.e. EOF1 and EOF2 of 500-hPa height anomalies in JJA. The EOF1 (EOF2) scores derived from different members are statistically biased negatively (positively), which means positive anomalies would be dominant in the middle latitudes in the Northern Hemisphere.

(Akihiko Shimpo, Climate Prediction Division)

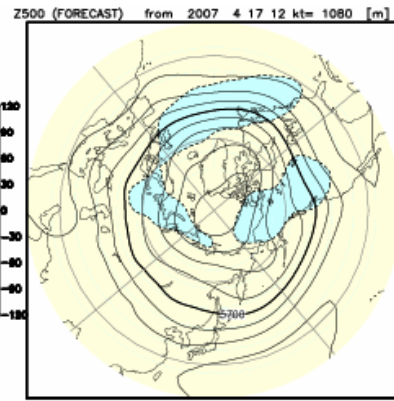


Figure 6 Predicted 500hPa height in the Northern Hemisphere for 2007 JJA (Ensemble mean of 31 members) Contour interval is 60 m. Anomalies are shaded.

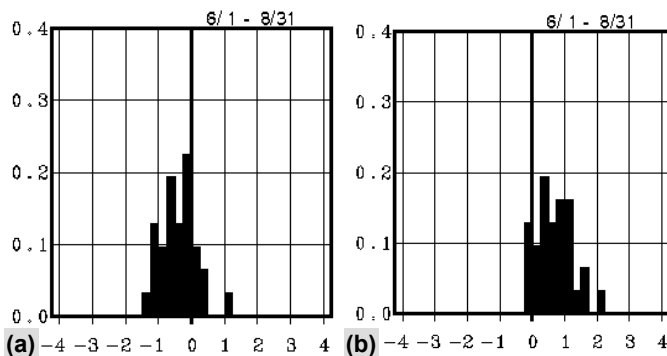
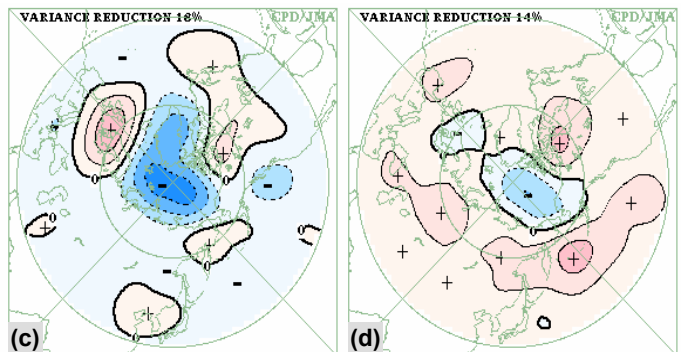


Figure 7 Histogram of predicted (2007 JJA) (a) EOF1 and (b) EOF2 scores defined by the (c) first and (d) second EOFs of 500hPa height anomalies in the Northern Hemisphere



Warm Season Outlook for 2007 Summer in Japan

For 2007 summer in Japan, mean temperatures are likely to be normal or above normal in most regions. Precipitation amounts are likely to be normal in most regions except the northern part where they are more likely to be above normal.

1. Outline of the outlook

JMA issued an outlook for the coming summer over Japan in February and updated it in March and once again in April. It expects a hot summer with a larger probability (50% or 40%) than the climatological one (33%) in most parts of Japan, and a wet or normal summer with a large probability (80%) in the northern part.

A subtropical high is expected to cover Japan to an extent normal or above normal during this summer. The activity of the bai-u front is expected to be normal, but the front is likely to stagnate in the northern part.

Probabilistic forecasts of mean temperatures and precipitation amounts for the whole summer, as well as precipitation amounts in the rainy (bai-u) season for different regions of Japan are available at the following URL.

Summer Outlook in Japan:

<http://ds.data.jma.go.jp/tcc/tcc/products/japan/outlooks/outlook3w.html>

2. Backgrounds for the outlook

Warming trends are obvious in summer temperatures in Japan, consistent with the warming trend of tropospheric thickness temperatures in the northern mid-latitudes. Actually, the main islands of Japan experienced seven hot summers in the recent ten years. The oceanic condition in the equatorial Pacific has changed drastically in March from an El Niño-like condition to a La Niña-like condition.

JMA's El Niño forecast model predicts that a La Niña condition is expected to start in this spring and last during summer. According to a statistical investigation, a hot summer is likely in eastern and western Japan during a La Niña event.

JMA's seasonal forecast model predicts that convective activities will be slightly suppressed around the Bay of Bengal. It means that the Asian monsoon activity, which is positively related to summer temperatures mainly in northern part, will be a little weaker than normal. In this regard, it should be noted that the forecast model has an insufficient prediction skill over the Indian Ocean with the lead time of several months. The forecast model also predicts enhanced convective activities in the Philippine Sea. It means that the subtropical high, which brings a hot summer to Japan, is expected to be normal or above normal in strength. The prediction skill for the Western equatorial Pacific is superior to the one for the Indian Ocean.

In regard to the extra-tropical circulation, 500 hPa height anomalies and 850 hPa temperature anomalies are predicted to be positive in most of the Far East. Therefore, the statistical guidance based on the seasonal prediction model outputs shows a larger probability of above normal temperatures in Japan. However, it should be aware that the predicted SLP anomaly suggests Okhotsk highs appearing temporarily, which often bring a cool summer mainly in northern Japan. In addition, an attention should also be paid to the present progress of the Asian summer monsoon because cool and wet summers were experienced following the latest three El Niño events.

(Shunji Takahashi, Climate Prediction Division)

Summary of Asian Winter Monsoon 2006/2007

1. Extreme Climate Events

Heavy rains in Southeast Asia (December 2006 – January 2007)

It was drier than normal until November 2006 in Southeast Asia, but it became rainy in December and heavy rains occurred in the southern Malay Peninsula and northern Sumatra Island from around 17 December. More than 200 fatalities by floods and landslides were reported in northern Sumatra and about one million of people affected by floods in southern Malaysia.

SYNOP data in the affected countries show that ten-day precipitations for the period from 17 to 26 December were more than 600 mm at Changi Airport in Singapore (normal

monthly precipitation is 299.8 mm) and more than 200 mm in the northern Sumatra Island (Figure 8).

In relation to the eastward propagation of the Madden-Julian Oscillation (MJO) in the tropics, convective activities were above normal over the area from the Indian Ocean to Southeast Asia from mid-December 2006. At the same time, enhanced anti-cyclonic circulation over southern China brought cold northeastern monsoon winds from the middle latitude to Southeast Asia (Figure 9).

It is considered that the active convection due to MJO and the cold surge from the Chinese continent relates to the heavy rains in the southern Malay Peninsula and the northern Sumatra Island.

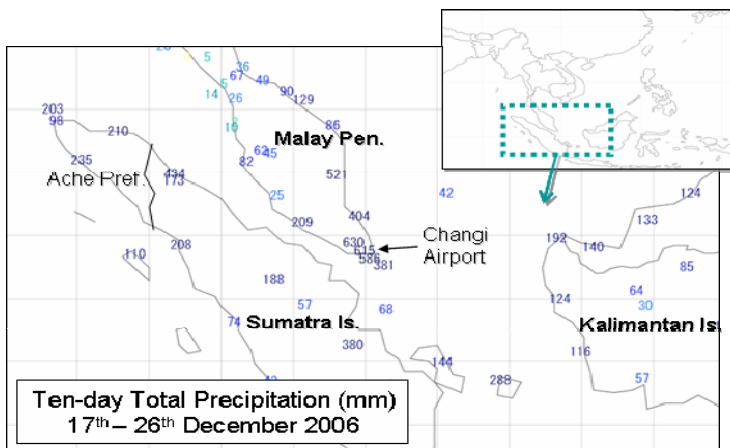


Figure 8 Ten-day total precipitation amounts around the Malay Peninsula

Numbers in the figure denote total precipitations derived from SYNOP reports on 17-26 December 2006.

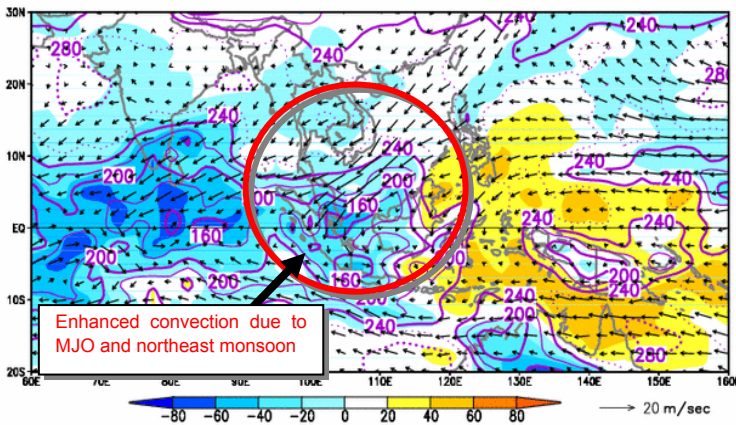


Figure 9 Weekly mean of OLR, its anomaly and 850 hPa wind (20-26 December 2006)

OLR data are derived from the observations by NOAA's polar orbital satellite. Solid contours show OLR (contour interval: 20 W/m^2), shadings show OLR anomalies and arrows show 850 hPa winds. Blue (red) shadings denote areas of stronger (weaker) than normal convective activity. Base period for normal is 1979-2004.

2. Atmospheric circulation

The center of the Aleutian Low shifted eastward from its normal position and the Siberian High was weak from its center to eastern Siberia (Figure 10). This indicates that the northeastern Asian winter monsoon was weak and the cold surges occurred less frequently. Three-monthly mean temperatures at 850 hPa (Figure 11) were significantly above normal over eastern Asia. In particular, temperature anomalies normalized by the standard deviations exceeded 2.0 from the south of Lake Baikal to northeastern China. As to the features of the upper level tropospheric circulation, which brought an extremely warm winter to northeastern Asia, the seasonal mean polar jet was remarkably clear and stronger than normal from

Europe to Lake Baikal, which is unclear in the climatological condition (Figures 12a and 12b). This condition was often seen throughout the season. The jet from northern America to the Atlantic was also stronger than normal. On the other hand, the sub-tropical jet was weaker than normal over the south of Japan, where the maximum wind speed existed in the climatological condition. These features indicate that the polar jet and the subtropical jet were clearly separated from each other over Eurasia. More details are available at the TCC website: http://ds.data.jma.go.jp/tcc/tcc/products/clisys/topics/topics_200703_1.pdf

(1: Hidehiko Isobe, and 2: Yayoi Harada, Climate Prediction Division)

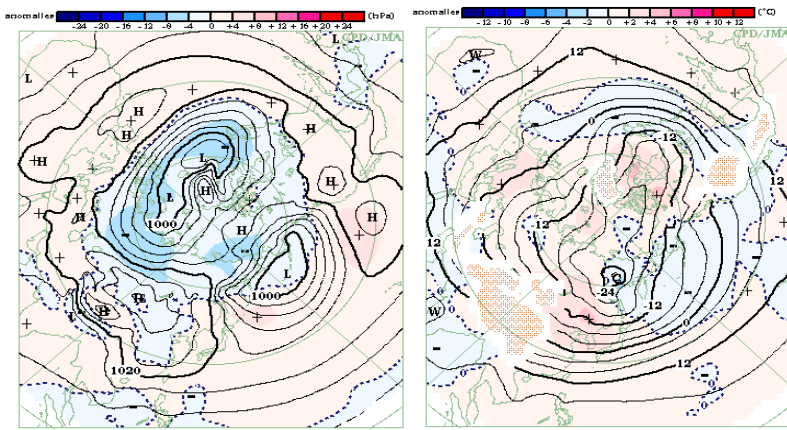


Figure 10 (left) Winter 2006/07 mean sea level pressure and anomaly in the northern hemisphere
 Contours show sea level pressure at intervals of 4 hPa. Shadings show SLP anomalies. Base period for normal is 1979-2004.

Figure 11 (right) Winter 2006/07 mean 850 hPa temperature and anomaly in the northern hemisphere
 Contours show temperatures at intervals of 4°C. Shadings show temperature anomalies. Base period for normal is 1979-2004.

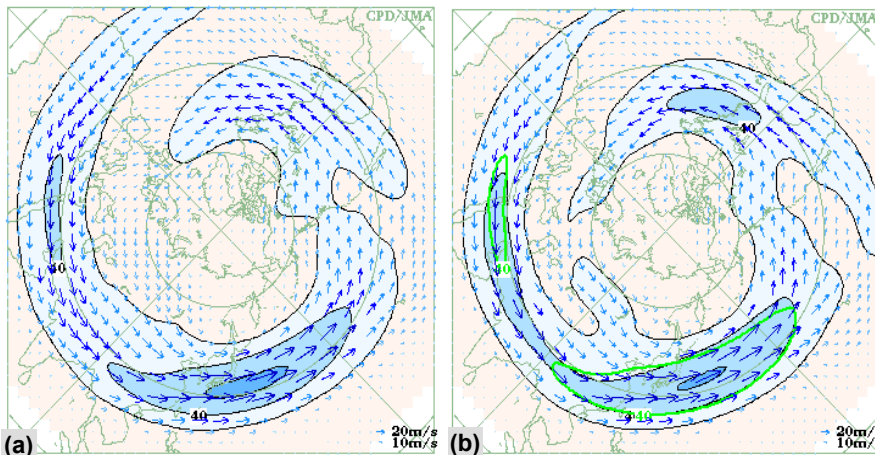


Figure 12 Winter 2006/07 mean 300 hPa wind vectors in the northern hemisphere (a) Normal, (b) Winter 2006/2007
 Black lines show wind speeds at intervals of 20 m/s. Blue shadings show values greater than 40 m/s. Green lines show normal wind speeds at intervals of 40 m/s. Base period for normal is 1979-2004

Launch of New TCC Website

The Tokyo Climate Center (TCC) of JMA launched a new TCC website on 27 March 2007 (URL: <http://ds.data.jma.go.jp/tcc/tcc/index.html>). Please change your bookmarks to the new URL.

The previous TCC websites <http://cpd2.kishou.go.jp/tcc/> and <http://okdk.kishou.go.jp/> will remain available until July 2007.

TCC will continue to make efforts in order to extend and enhance the lineup of TCC products to meet the needs and requirements of NMHSs in the region.

For example, TCC plans to provide a probabilistic extended-range forecast of precipitation and temperature for major observation stations in Southeast Asia through the website this year. Your comments on TCC products are most welcome. Please contact tcc@climar.kishou.go.jp.

(Kumi Hayashi, Climate Prediction Division)

International Workshop on the Applications of Advanced Climate Information in the Asia-Pacific Region

The Tokyo Climate Center (TCC) held an “International Workshop on the Applications of Advanced Climate Information in the Asia-Pacific Region” at the JMA Headquarters in Tokyo, Japan from 20 to 22 February 2007, under the auspices of the Ocean Policy Research Foundation. All the abstracts and presentation materials are available at: http://ds.data.jma.go.jp/gmd/tcc/tcc/library/OPRF_WS2007.html

On the first day of the Workshop, “Open seminar on the applications of climate information in various socio-economic sectors” was held with the attendance of four invited lecturers. About 150 participants in total, including 65 from users’ sectors, joined the seminar. On the second and third days of the Workshop (21 and 22 February), the “Workshop on the application of advanced climate information in the Asia-Pacific region” was held with 14 presentations.

Through the presentations and discussions, all the participants in the Workshop came to share the following recognition required to enhance the socio-economic value of climate information in the Asia-Pacific region.

- (1) Communication with potential users of climate information is essential. Climate information should be developed in a user-oriented manner. In order for the users of climate information to understand the uncertainty/reliability/utility of climate predictions and for the providers of it to understand the real needs for climate prediction, climate outlook forum/workshop involving users' community on a regular basis could be effective.
- (2) We need to realize the decision-making processes and which parts of them are affected by climate variability and change. Intermediary companies/institutions and/or social scientists are expected to significantly contribute to relevant researches.
- (3) NMHSs should provide users with relevant indices, such as Heating/Cooling Degree Days, number of precipitation days and temperature-humidity combined index, and evaluate the prediction skill of each element.
- (4) Southeast Asian countries have increasing societal needs for the advanced climate information, including prediction and its application. NMHSs in these countries are in need of regional climate prediction products and/or technology transfer by the RCCs in RA-II.
- (5) The JRA-25 dataset is the first re-analysis dataset in Asia and is suitable for the researches in variability of Asian monsoon activity, tropical cyclones and Meiyu-Changma-Baiu frontal system. It is expected and recommended to conduct researches using the JRA-25 data in each country.
- (6) It has been indicated that the MME method is useful for effective use of climate prediction model outputs produced by the Global Prediction Centers (GPCs), including CMA, KMA and JMA. It is necessary to promote international cooperation for applying the MME method to operational seasonal forecasting.
- (7) International exchange of data, especially meteorological and hydrological observation data which are provided only to domestic users, is quite important to develop and verify downscaling techniques and their applications.

BCC of CMA and TCC of JMA introduced their activities and future plans as the RCCs in Asia to promote international cooperation in the development of prediction products suitable for application use and capacity building. The requirements of Southeast Asian countries to the RCCs are summarized as follows:

- (a) For advanced application of climate information, a faster- and larger-capacity communication network should be established.
- (b) Since the climate in RA-II is quite different from a sub-region to another, it is desirable to hold a Climate Outlook Forum in each of the sub-regions, such as South Asia, Southeast Asia and East Asia. Some ASEAN countries, such as Malaysia and Indonesia, are the members of RA-V, so that cross-regional collaboration between RA-II and RA-V should be considered.
- (c) Climate change is one of the common issues to tackle in the region. The role of the RCCs in this matter should be stressed and clarified. Regional climate change scenarios provided by RCCs would be useful.
- (d) It was shown that there exist some predictable signals in the forecast with a lead-time ranging from a week to four weeks, although the predictability differs between sub-regions. It is useful that the RCCs develop some application products derived from forecasts targeting within one month ahead, and provide monitoring results of the current situation.
- (e) It is useful that the RCCs continually provide web-based and easy-operating application tools for the use of NMHSs.
- (f) Technology transfer from the RCCs to NMHSs through training courses and workshops, particularly the ones regarding new techniques in climate applications, is required.

*(Shingo Yamada,
Fukuoka District Meteorological Observatory)*



Report on the Status of Heat Islands in the Kinki Region for the Summer of 2006

The Japan Meteorological Agency (JMA) analyzed heat island effects on the climate of the Kinki region for the summer of 2006. JMA issued a report (in Japanese) on this analysis.

In August 2006, this region received a longer sunshine with a lot of sunny days and the monthly mean temperatures exceeded normal in many places. Figure 14 shows a time series of monthly mean temperatures of August in Osaka, in comparison with Tokyo, in which a statistically significant increasing trend of 1.17°C per 50 years was analyzed. This trend is larger than the corresponding value of Tokyo, 0.83°C, and two or three times larger than that in areas not affected by urbanization.

JMA made an analysis through a numerical experiment by taking 12 cases in which a Pacific subtropical high pressure covered the region and a breeze blew from the sea. Findings from this experiment are as follows:

- (1) On average, an area of high temperature above 25°C covered areas from the coast of Osaka Bay to the northeast of Osaka at 5 a.m. (Figure 15a). At 3 p.m.,

such areas extended to the basins of Kyoto and Nara, with a core exceeding 35°C from the east of Osaka to Kyoto (Figure 15b).

- (2) A numerical simulation to quantify the effects of urbanization indicated that areas with such effects were limited to coastal areas at 5 a.m. (Figure 16a) while such areas extended to the whole plain at 3 p.m. (Figure 16b). When simulated for calm and clear days, such differences within a day are typically analyzed, as previously shown in the case of areas around Tokyo. The area affected by urbanization was smaller in Osaka than in Tokyo, because of smaller urban areas near Osaka.
- (3) It was also simulated that a cooler breeze blowing from Osaka Bay in the late afternoon was heated to be forced up by urban land cover and artificial heat emissions, which avoided the cooler air flow from proceeding to inland areas, including the northeast of Osaka, Kyoto and Lake Biwa (Figures 16b and 17).

(Hiroshi Nirasawa, Climate Prediction Division)

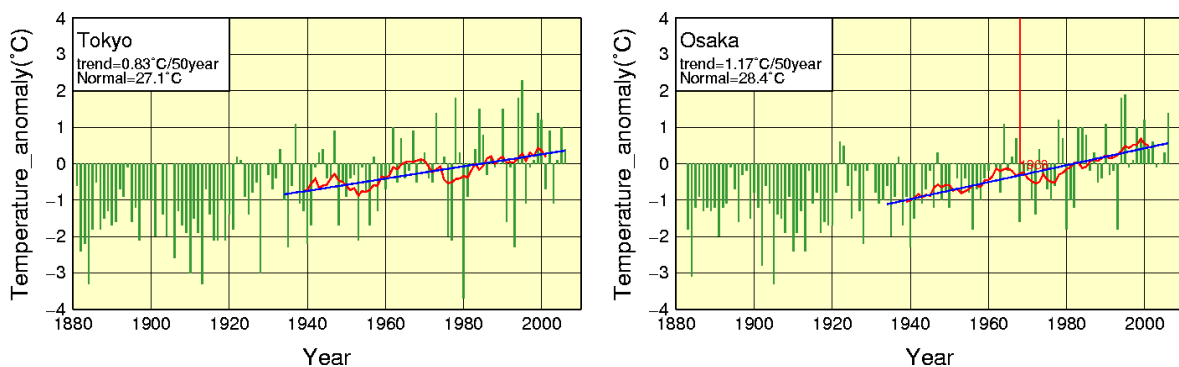


Figure 14 Time series of monthly mean temperature for August in Tokyo and Osaka. Red and blue lines indicate 11-year running mean and long-term linear trend from 1934 to 2006, respectively.

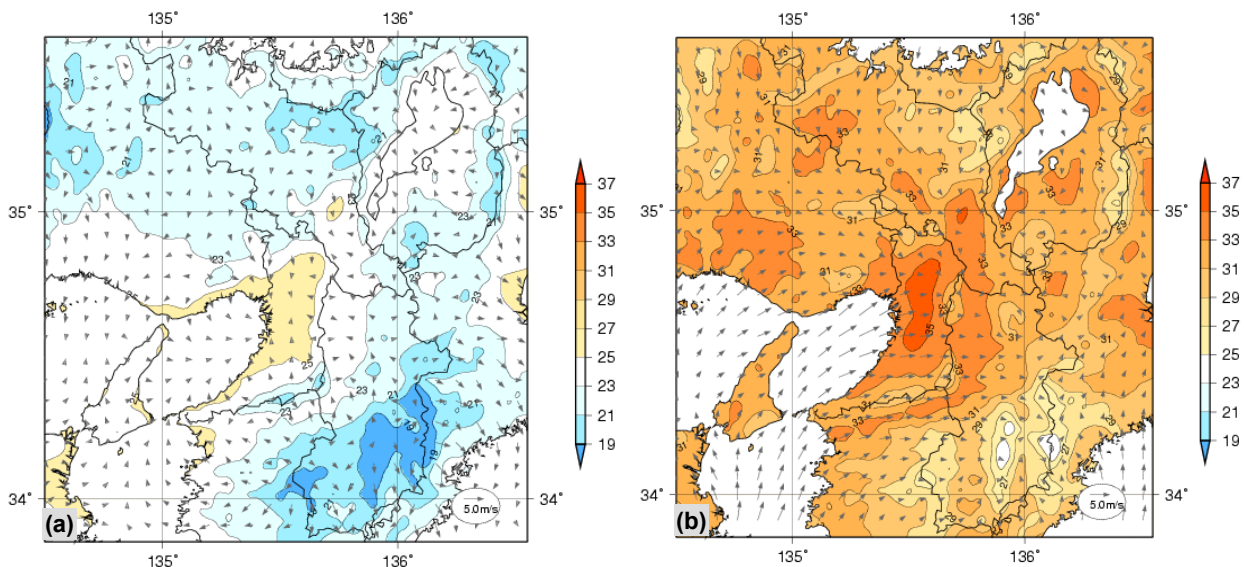


Figure 15 Distribution of surface temperature and wind in the Kinki region at 5 a.m. (a) and 3 p.m. (b), averaged over 12 cases for calm and clear days

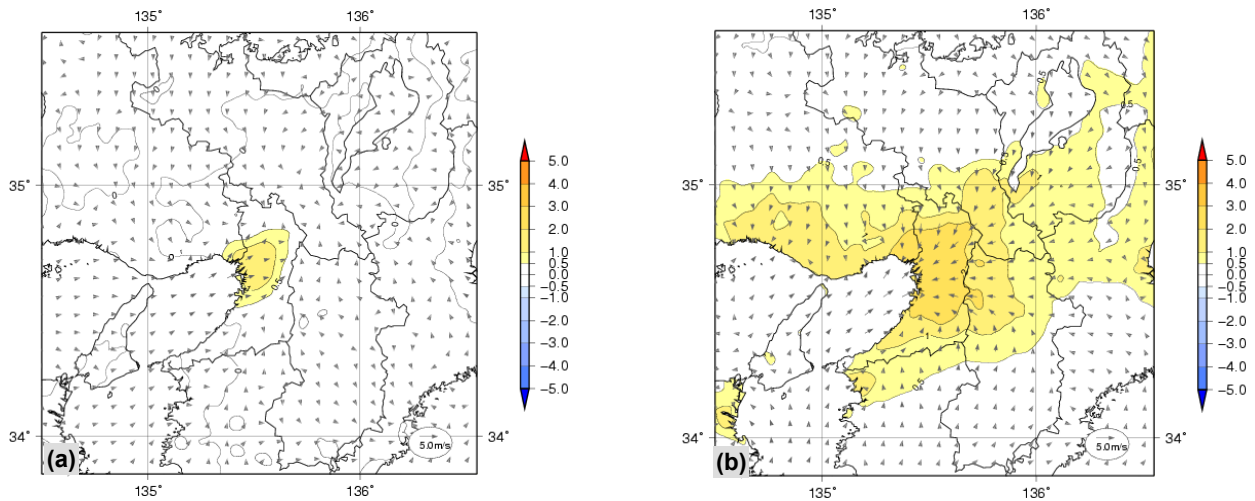


Figure 16 Simulated distribution of urban effects at 5 a.m. (a) and 3 p.m. (b), expressed as temperature and wind with urban effects averaged over the 12 cases deviated from simulation without such effects. Warm colors indicate positive urban effects.

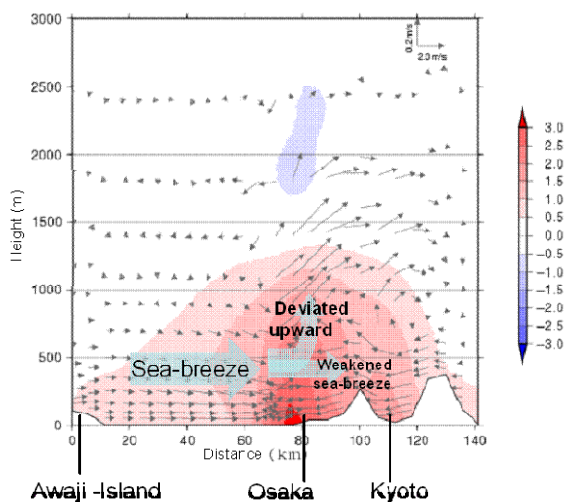


Figure 17 Vertical cross section of simulated effects of urbanization, expressed as temperature and wind with urban effects deviated from simulation without such effects in the case of 3 p.m., 5 August 2006. Warm colors indicate positive urban effects.

Stratospheric Major Warming Event from February to March 2007

Two stratospheric sudden warming events took place from February to March 2007. One of the events was identified as “Major Warming”.

The Climate Prediction Division of JMA routinely monitors the stratospheric circulation, focusing on Stratospheric Sudden Warming (SSW) events. STRAT-ALERT reports are issued everyday during the occurrence of SSW.

In 2006/2007 winter, two SSW events occurred. These events which occurred from 3 to 9 February 2007 and from 22 February to 3 March 2007 were classified as “Minor Warming” and “Major Warming”, respectively.

When the latter occurred, the polar vortex shifted to the eastern side of the hemisphere. Temperatures were distributed in a meridionally reversed manner in the zonal mean field and easterly winds were observed over the polar region. These conditions continued until the beginning of March. Temperature at 30 hPa was almost below normal except for the periods of the two warming events (Figure 18). The major warming event was not remarkable in comparison with the event which occurred in 2005/2006 winter. More details on the events in 2006/2007 winter are available at the TCC website: http://ds.data.jma.go.jp/tcc/tcc/products/clisys/topics/topics_200703_2.pdf.

(Hiroshi Hasegawa, Climate Prediction Division)

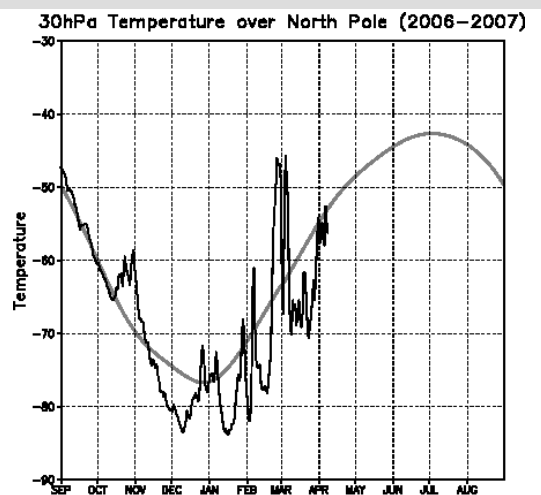


Figure 18 Time series of temperature at 30hPa over the North Pole in 2006/2007 winter. Black line shows 2006/2007 winter. Gray line shows normal.

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

(Chief Editor: Kumi Hayashi)

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