Tokyo Climate Center, Japan Meteorological Agency

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Contents

El Niño Outlook (October 2006 - April 2007)

The NINO.3 SST will continue to be above normal through the autumn to the winter, and then, will decrease and will be near normal from the winter to the spring. At present, it is less likely that El Nino event will develop in the prediction period than not. However, there remains some possibility that the above normal SST condition would continue through the winter and would be the development of El Nino event.

The SST deviation from a sliding 30-year mean SST averaged over NINO.3 region was +0.8˚C for September 2006. In September 2006, SSTs were above normal in much of the equatorial Pacific and positive SST anomalies exceeding +1˚C were found especially around the dateline and the eastern part (Figure 1 and Figure 2a). The subsurface temperatures were above normal in the central and eastern parts. Convective activities were above normal in the western equatorial Pacific and were near normal in the other parts.

The subsurface warm waters, which had appeared around the dateline in the middle of August, moved eastward and reached off the South American coast in late September (Figure 2b). In September, the atmospheric conditions were on the whole near normal, and easterly wind

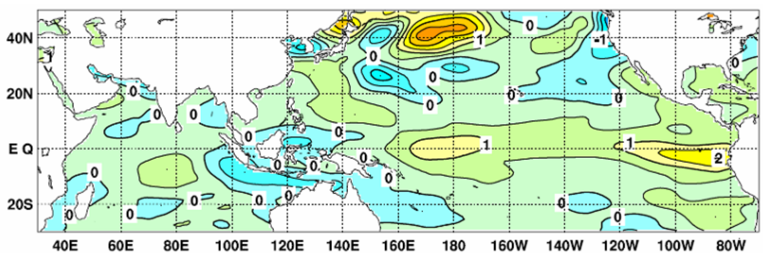


Figure 1 Monthly mean SST anomalies in the Pacific and Indian Oceans.

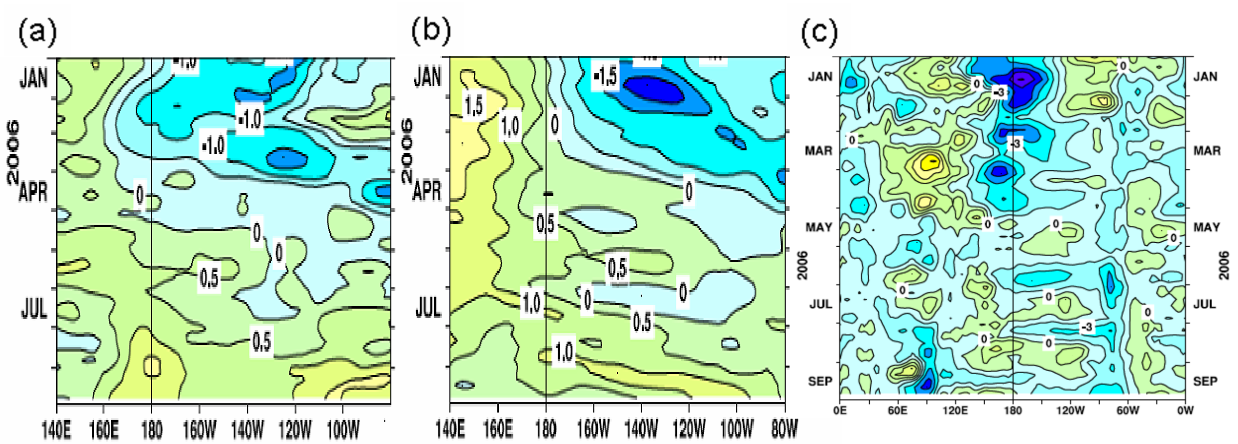
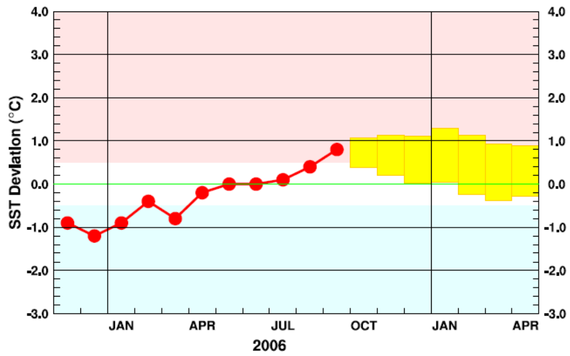


Figure 2 Time-longitude cross section of (a) SST anomalies along the equator in the Pacific Ocean, (b) ocean heat content (OHC; vertically averaged temperature in the top 260 m) anomalies along the equator in the Pacific Ocean by ODAS, (c) zonal wind anomalies at 850 hPa along the equator.

anomalies at the lower troposphere have been found in the central and eastern equatorial Pacific since the middle of September (Figure 2c). Considering the above, it is unlikely that NINO.3 SST anomaly will increase further (Figure 2a). On the other hand, it should be taken into account that the subsurface warm waters due to the lower troposphere westerly wind anomalies which were found over the western equatorial Pacific in late September will maintain or increase NINO.3 SST anomaly during the autumn and the winter (Figure 2c).



The JMA's El Nino forecast model predicts that the NINO.3 SST will be above normal through the autumn to the winter and near normal from the winter to the spring (Figure 3).

Considering all the above, The NINO.3 SST will continue to be above normal through the autumn to the winter, and then, will decrease and will be near normal from the winter to the spring. At present, it is less likely that El Nino event will develop in the prediction period than not. However, there remains some possibility that the above normal SST condition would continue through the winter and would be the development of El Nino event.

(*Ikuo Yoshikawa, Climate Prediction Division*)

Figure 3 Outlook of the SST deviation for NINO.3 by the El Niño forecast model.
This figure indicates a time series of the monthly sea surface temperature (SST) deviation for NINO.3 (5°N-5°S, 150°W-90°W). Thick line with closed circle shows the observed SST deviation and boxes show the predicted one for the next six months by the El Niño forecast model. Each box denotes the range where the SST deviation will be included with the probability of 70%.

Seasonal Numerical Ensemble Prediction for 2006/2007 winter

The JMA's seasonal numerical ensemble prediction for 2006/2007 winter (DJF) shows that winter-mean atmospheric circulation fields in the tropics and sub-tropics resemble the ones typically observed during El Niño events. The predicted probabilities of above-normal category of 500 hPa geopotential height anomalies are high in eastern Asia, though the Arctic Oscillation (AO) index would be around normal with considerable spread. These predicted circulation fields suggest that the temperatures will be above normal over eastern Asia, though the prediction has large uncertainty in the area where the climate is strongly affected by the AO, such as the northern part of Japan.

1. Introduction

In this report, JMA's seasonal numerical ensemble prediction for 2006/2007 winter (DJF), which was used for one of the prognostic tools for the JMA's operational cold season outlook issued on 25th September 2006, is introduced. The prediction consists of 31 ensemble members whose initial dates are 14th September 2006, and employs the two-tier method: first, global SSTs are predicted using a combination of persisted anomalies, climatology and prediction with the JMA's El Niño prediction model (CGCM), and then the specific SSTs are fed in an atmospheric model (AGCM). Details on the prediction system and verification maps based on 21-year hindcast experiments are available at http://okdk.kishou.go.jp/products/model/index.html. In the report, firstly the predicted global SST anomalies are presented. Then, the predicted circulation fields in the tropics and sub-tropics associated with those SST anomalies are described. Finally, the predicted circulation fields in the middle and high latitudes in the Northern Hemisphere are explained.

2. SST anomalies (Figure 4)

During 2006/2007 winter, SSTs in the equatorial Pacific are predicted to be near normal in the western part and positive anomalies exceeding +0.5°C in the central and eastern parts. This anomaly pattern is similar to the one typically observed during El Niño events, although the possibility of a major El Niño event developing in this coming winter is relatively low as mentioned in the previous article of this issue. In the tropical Indian Ocean and the tropical Atlantic, above normal SST anomalies are broadly predicted. Especially, positive anomalies greater than +0.5 °C are seen in the central part of the tropical Indian Ocean.

In the Northern Hemisphere mid-latitudes, positive SST anomalies are predicted except in the eastern part of the north Pacific.

3. Predicted ensemble-averaged circulation fields in the tropics and sub-tropics (Figure 5)

As expected from the predicted SST anomalies, the predicted ensemble-averaged winter mean atmospheric circulation fields in the tropics and sub-tropics resemble the ones typically observed during El Niño events.

The amounts of precipitation in the tropics are predicted to be above normal in the central and eastern Pacific and in the Indian Ocean and to be below normal in the western Pacific and in the maritime continent. Corresponding to these anomalies, the velocity potential anomalies at 200 hPa are positive

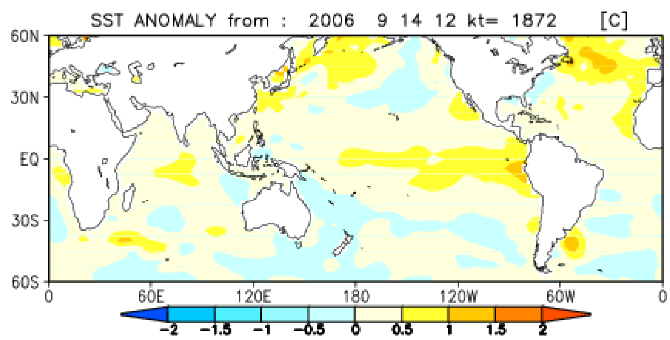


Figure 4 Predicted SST anomalies for 2006/2007 DJF.

(more convergent) over the maritime continent and negative (more divergent) in the vicinity of the dateline and over the western Indian Ocean. In the lower troposphere (850 hPa), a pair of cyclonic circulation anomalies on both sides of the equator are seen in the central Pacific and a pair of anti-cyclonic anomalies from southeastern Asia to the eastern Indian Ocean.

Although there is a indication of a stationary Rossby wave train along the Asian Jet in the upper troposphere (200 hPa), that is, anti-cyclonic circulation anomalies in southwestern Asia and over Japan and cyclonic ones in the southern part of China, we have to take it weaker than predicted, because it might be excited by the anomalous precipitation over the Indian Ocean where the model has relatively poor prediction skills for precipitation.

4. Circulation fields in middle and high latitudes (Figure 6 and Figure 7)

The ensemble-averaged 500 hPa geopotential height anomalies are predicted to be positive in most of the Northern Hemisphere low-latitudes (Figure 6). In the Northern Hemisphere mid-latitudes, negative 500 hPa geopotential height anomalies are located near the Aleutian, the Urals, the northern part of the North Atlantic and southwestern USA, and positive ones are centered over Japan, central Europe and western Canada. The probabilities of above-normal category are high in the Northern Hemisphere low-latitudes and eastern Asia, and there are not any areas where the probability of below-normal category is high (Figure 6). However, the high probabilities in eastern Asia have to be modified, because they are related to the stationary Rossby wave train mentioned in the previous section.

At CPD/JMA, the AO index is defined as the score of the first EOF of the three-month mean (DJF) 500 hPa geopotential height, which shows the leading mode of the low frequency variability of the atmosphere in the Northern Hemisphere winter (Figure 7: right). The predicted AO index by the JMA's ensemble prediction system is near normal on average with considerable spread among the members (Figure 7: left). This means that the seasonal predictions have large uncertainty in the areas where the climate is strongly affected by the AO, such as the northern part of Japan.

(*Shuhei Maeda, Climate Prediction Division*)

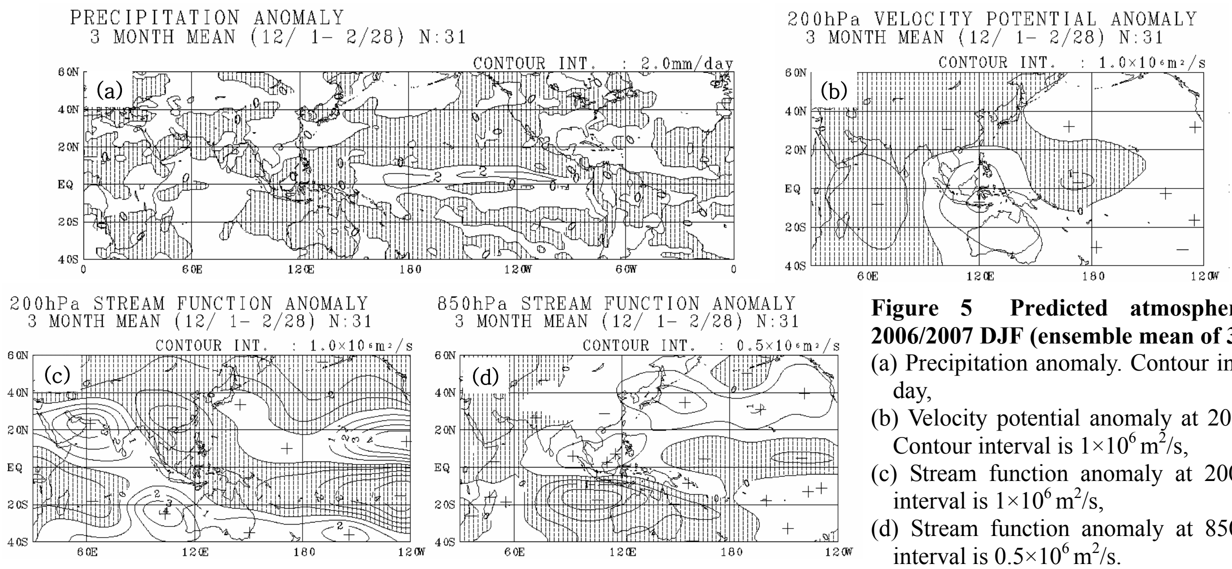


Figure 5 Predicted atmospheric fields for 2006/2007 DJF (ensemble mean of 31 members).

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

(b) Velocity potential anomaly at 200 hPa anomaly. Contour interval is 1×10^6 m^2/s,

(c) Stream function anomaly at 200 hPa. Contour interval is 1×10^6 m^2/s,

(d) Stream function anomaly at 850 hPa. Contour interval is 0.5×10^6 m^2/s.

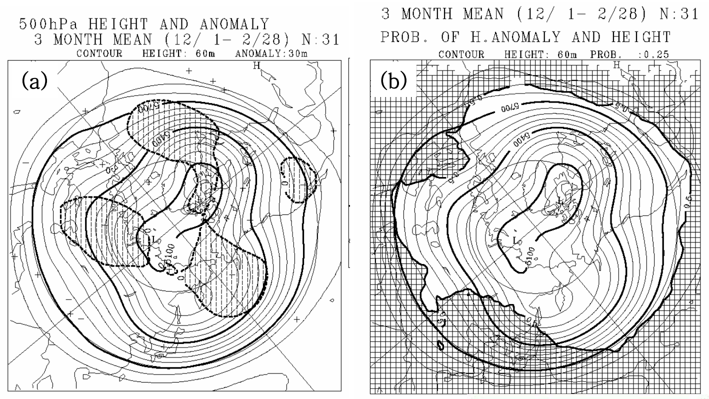


Figure 6 Predicted 500 hPa heights in the Northern Hemisphere for 2006/2007 DJF.

(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.

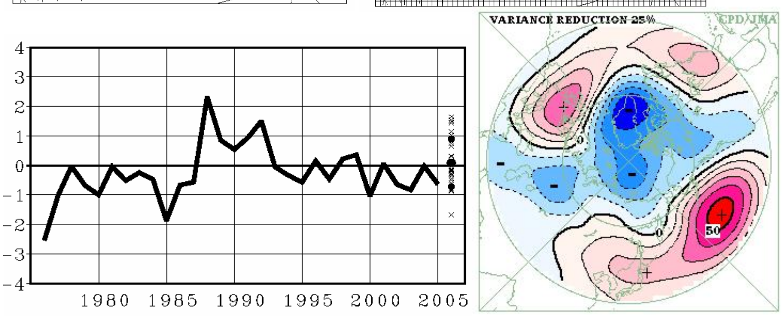


Figure 7 Observed (1976/77-2005/2006 DJF) and predicted (2005/2006 DJF) AO index (left) defined by the first EOF of 500 hPa height anomalies in the Northern Hemisphere (right).

In the left panel, thick line shows time series of observed AO indices. Black circles are ensemble mean and ensemble mean ± spread. Cross shows each member

Cold Season Outlook for 2006/2007 winter in Japan

For 2006/2007 winter in Japan, winter mean temperature is likely above normal with possibility of 50% in its eastern, western and south-western parts, normal/above normal with possibilities of 40% each in its northern part. The outlook is mainly based on the reasons that during this winter it is likely for the SST anomaly pattern to remain El Niño-like, for above-normal tropospheric air temperature in the mid-latitudes to persist, and for the Arctic Oscillation (AO) to be negative according to its multi-decadal oscillation.

1. Outline of the outlook

JMA issued the Cold Season Outlook for 2006/2007 winter in Japan on 25 September 2006. Winter monsoon is expected to be weaker and warm days are likely to be more frequent than normal year in all regions, though in Northern Japan possibility of normal winter is slightly higher than other regions.

Snowy days are likely to be less than normal in the Japan Sea side and wetter-than-normal weather is expected in Western Japan and the Pacific side of Eastern and Northern Japan due to weaker monsoon pattern and frequent cyclone passage along the Pacific off-coast.

Probabilistic forecasts of winter mean temperatures, winter precipitation amounts, and snowfall amounts for the primary forecast regions of Japan are available at the following URL.

Cold Season Outlook in Japan:
http://okdk.kishou.go.jp/outlooks/outlook3c.html

2. Backgrounds for the outlook

The climatic trends in recent 10 years show that the winter mean temperatures in Japan are almost above/near normal, especially in southwestern Japan, where they clearly tend to be warmer than normal. However, in the northern part of Japan, large fluctuations of temperature were observed during last 5 years. The snowfall amounts in recent 10 years were near or below normal all over Japan. The thickness temperature between 300 hPa and 850 hPa averaged over the mid-latitudes (30°N-50°N) is positively correlated with the temperatures in Japan. It generally continues to be above normal since 2003, and the same situation is likely to persist during this winter. The winter mean AO index (when it's positive, the 500 hPa height anomalies are negative in the arctic area and positive in the mid-latitudes) tends to be negative since 1995/1996 winter. This suggests the polar air mass is likely to flow out over the North Pacific, which might occasionally cause cold winters mainly in the northern part of Japan. In the last winter, strong cold surges frequently occurred accompanied with strong negative AO and it brought serious disasters and over 150 deaths mainly due to accidents in snow removal on the roof. On the other hand, the SST anomaly in NINO.3 region became positive in August and the situation continued through September. It is likely that the El Nino-like anomaly pattern continues during winter. So, more or less, the El Niño-like effects, which in short words tend to bring warmer winter to Japan, are taken into account. As for the ensemble prediction, please refer to “JMA’s Seasonal Numerical Ensemble Prediction for 2006/2007 winter” in this issue.

(*Shunji Takahashi, Climate Prediction Division*)

Meeting announcement: *“International Workshop on the Applications of Advanced Climate Information in the Asia-Pacific Region”*

The Tokyo Climate Center (TCC), Japan Meteorological Agency (JMA), will hold an “International Workshop on the Applications of Advanced Climate Information in the Asia-Pacific Region” at the JMA headquarters in Tokyo, Japan, on 20-22 February 2007 under the auspices of the Ocean Policy Research Foundation*. The main purposes of the workshop are set as follows:

1) *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,*
2) *to summarize the operational and development activities on the climate information and its applications in the Asia-Pacific nations and to identify the requirements and capabilities for the research and development of the tailored climate information products which are relevant to the mitigation of climate-related hazards in various socio-economic sectors, and*
3) *to summarize the requirements to be filled by the Tokyo Climate Center of JMA, one of the Regional Climate Center Network in Regional Association II of the World Meteorological Organization (WMO), to assist the National Meteorological and Hydrological Services (NMHSs) in the Asia-Pacific region in issuing advanced climate information tailored for socio-economic usage.*

Tentative Agenda

20 February 2007 Open seminar on the applications of climate information in various socio-economic sectors

21-22 February Workshop on the application of advanced climate information in the Asia-Pacific region

Session 1: Reports on the status and future plans of climate information and its application for the domestic users

Session 2: Recent developments which would serve for the advancement of climate information and its application in the Asia-Pacific region

Session 3: International cooperation for advancing the climate information and its application in the Asia-Pacific region

***Ocean Policy Research Foundation:**
Ship & Ocean Foundation (SOF), alias Ocean Policy Research Foundation, was established in 1975. Under support from The Nippon Foundation, the private non-profit organization is undertaking activities related to a wide range of maritime issues. As the scope of its activities have expanded, SOF has recently adopted a new name, "Ocean Policy Research Foundation," which better illustrates their current concerns and operations --- multi-disciplinary researches into ocean-related issues to make practical policy proposals in the areas of marine environment protection, maritime security, marine resources preservation, etc. OPRF is headquartered in Tokyo.

Summary of Asian Summer Monsoon 2006

The Indian monsoon rainfall was normal during June to September 2006. During the same period, precipitation was heavy in the Republic of Korea and the southeastern parts of China, while light in the remaining of China and western Indonesia.

1. Monsoon activities

Asian summer monsoon activities, inferred from the seasonal mean OLR (Outgoing Longwave Radiation) over Southeast Asia and India during the period from June to September 2006 (hereafter called "the monsoon season"), were near normal (Figure 8). In July, the Asian monsoon became active and the most active convection area of the Asian monsoon was significantly shifted eastward from its normal position.

According to India Meteorological Department (IMD), the southwest monsoon rainfall during the monsoon season over India as a whole was 100% of its long period average. The onsets of the monsoon were earlier than normal and normal over the southern and northern parts of India, respectively.

The total precipitation amounts during the Baiu season 2006 were greater than normal in most districts in Japan. The beginnings of Baiu season were equal to or later than normal in most districts in Japan, and the ends were later than normal except the Okinawa and Amami districts. Some districts in main islands of Japan had significantly above-normal precipitation in July. The total sunshine durations during the Baiu season were less than normal. For more details, please refer to the following reports.

Summary of the Baiu 2006:
http://okdk.kishou.go.jp/news/Baiu2006.html
Background of extremely heavy rain in July:
http://okdk.kishou.go.jp/news/topics_20060727.html

2. Precipitation and temperature

The four-month total precipitation amounts, based on CLIMAT reports, during the monsoon season were below normal over Mongolia, most of China and western Indonesia, while above normal in Korea and in northeastern Kalimantan Island, from the southeastern coast of China to Taiwan and from Pakistan to western India (Figure 9). In June, precipitation was extremely heavy from the Malay Peninsula to Kalimantan Island. In July, extremely heavy precipitation was observed from eastern Japan to the Korean Peninsula and from Mongolia to northern China. In August, precipitation was extremely light in Mongolia, from central China to northern India, while extremely heavy in central India. In September, precipitation was extremely light from the Korean Peninsula to northeastern China and from western Mongolia to northwestern China.

The four-month mean temperatures during the same period were higher than normal over most of Asia, though

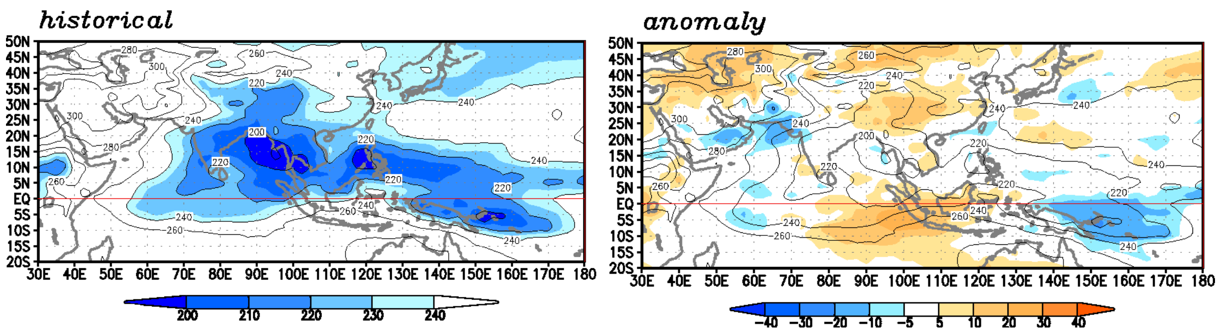


Figure 8 Four-month mean OLR (Outgoing Longwave Radiation) and anomalies (June-September 2006).
Solid lines indicate OLR (W/m^2) with a contour interval of 30 W/m^2.

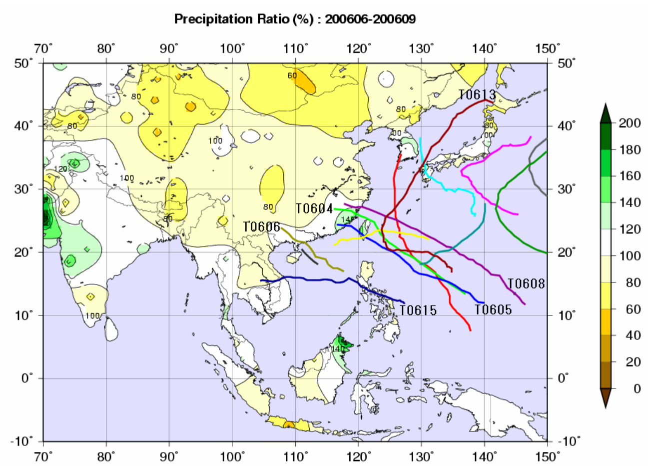


Figure 9 Four-month precipitation ratio (%) and tropical cyclone tracks during June to September2006.
"T06XX" in the figure shows international identification numbers.

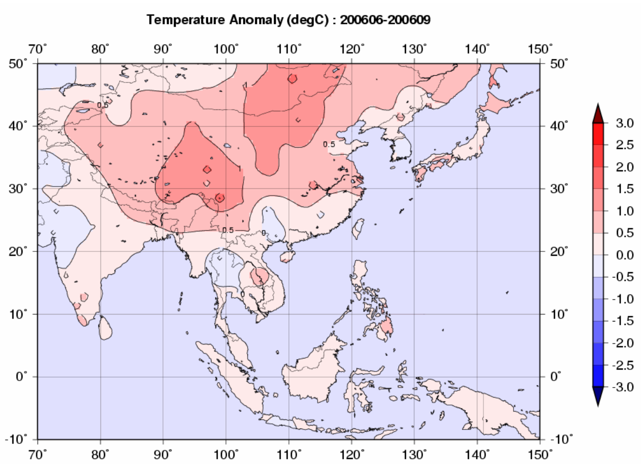


Figure 10 Four-month mean temperature anomaly (℃) during June to September 2006.

slightly lower in Korea, southern China, Taiwan, northern Thailand, Java Island and from western India to Pakistan (Figure 10). In June, temperatures were extremely high in China. In July, extremely high temperatures were observed from China to Nepal and from southern India to Kalimantan Island. In August, temperatures were extremely high across Mongolia through China to Japan. In September, extremely high temperatures were observed from eastern Mongolia to northeastern China.

3. Tropical Cyclones

During the monsoon season, 13 tropical storms occurred over the western North Pacific, and the number of the occurrence was below normal, the 1971-2000 average of 16.4 (Figure 9). There were six tropical storms causing damage to East and Southeast Asia (Table 1). From July to August, four tropical cyclones made landfall on southeastern China one after another, which caused devastating damage such as over 1100 fatalities in total. The typhoon "Shanshan" which hit Japan and Korea in the middle of September led to 10 deaths. The typhoon "Xangsane" crossed the Philippines in the end of September and made landfall on Vietnam on October 1, causing more than 110 and 59 fatalities, respectively.

4. Noticeable weather-related disasters other than tropical cyclones

Major weather disasters in Asia during the monsoon season, except for those related to tropical cyclones, are the following. In northern and western India, frequent heavy rain events from the latter half of May caused over 700 fatalities in total. Also in Pakistan, floods and landslides due to heavy rain occurred frequently in July and August, which led to more than 200 deaths. In addition, in June, heavy rain led to more than 250 fatalities in southern China. In Sulawesi Island in Indonesia, over 210 were died due to landslides in the latter half of June. In July, heavy rain caused by active Baiu front led to over 20 fatalities in Japan and more than 850 deaths or missing people in the Korean Peninsula. In August, drought caused severe damage in southwestern China, Bangladesh and northeastern India. In September, storms led to 170 deaths in India and Bangladesh.

5. Atmospheric circulation and convection

The northward propagation of active convection, led to by the active phase of the Madden-Julian Oscillation (MJO) passing across the equatorial Indian Ocean, reached southern India late May when the Indian monsoon was initiated approximately one-week earlier than normal (Figure 11). After the active phase passed, convection around India became inactive and persisted in the former half of June. The following northward propagation of active convection due to the MJO reached northern India early July when the northern monsoon onset was identified by the IMD. In July, convection was suppressed around the southern part of India, while extremely enhanced around the Philippines related to the deepened monsoon trough in the western tropical North Pacific. Although Asian monsoon overall became active in the beginning of August, it turned to be inactive after that and the long monsoon break persisted through the remaining of August. Asian monsoon became active again in September after the propagation of the active phase of the MJO across the Indian Ocean to the western tropical Pacific.

(1 and 5: Yayoi Harada and 2-4: Akiko Matsuda, Climate Prediction Division)

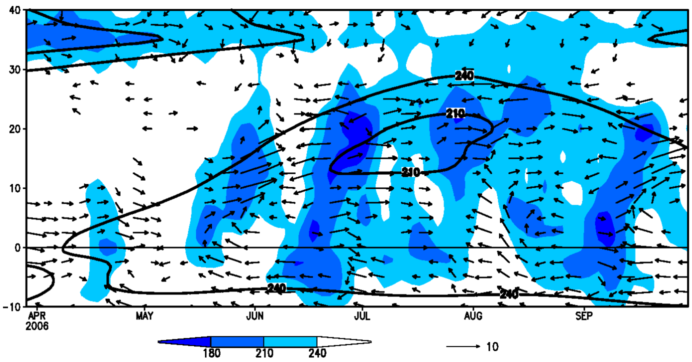


Figure 11 Latitude-time cross section of 5-day mean OLR and 850-hPa wind vector anomalies averaged in 65-85° E.
Solid line shows normal OLR (W/m^2) in an interval of 30 W/m^2 below 240 W/m^2. Shading shows OLR (W/m^2) in an interval of 30 W/m^2 below 240 W/m^2. Vectors show 850-hPa wind anomaly (m/s) over 2 m/s.

Table 1 Tropical cyclones which caused damage to East and Southeast Asia during June to September 2006.
Information and data are based on reports by RSMC Tokyo-Typhoon Center, other than "Fatalities" and "Affected Countries".

ID Number	Name	Date (UTC)	Category[1]	Min Pressure[2] (hPa)	Max Winds[3] (Knots)	Fatalities[4]	Affected Countries
T0604	Bilis	7/9- 7/15	STS	970	60	612	China
T0605	Kaemi	7/19 - 7/25	TY	960	80	25	China
T0606	Prapiroon	8/1 - 8/ 4	TY	970	65	80	China
T0608	Saomai	8/5- 8/10	TY	925	95	436	China
T0613	Shanshan	9/10- 9/ 19	TY	925	100	10	Japan, Korea
T0615	Xangsane	9/26 - 10/ 1	TY	940	90	110 (59)	The Philippines (Vietnam)[5]

1) Intensity classification of tropical cyclones
STS: Severe Tropical Storm, TY: Typhoon
2) Estimated minimum central pressure
3) Estimated maximum 10-minute mean winds
4) The number of fatalities is based on media reports, except on reports from Japan Fire and Disaster Management Agency for cases in Japan
5) The death toll in Vietnam includes fatalities in October

Statistical Relationships between El Niño/La Niña Events and Global Climate and Atmosphere

During El Niño events, Japan except its northern part is likely to experience warm in winter and spring, while cool in autumn together with the Korean Peninsula and northeastern China. Southeast Asia tends to experience warm and dry throughout the year except summer.

1. Introduction

In March 2006, JMA introduced new global sea surface temperature (SST) analysis data (COBE-SST) for climate system monitoring. At the same time, the index for defining El Niño/La Niña events was modified. The details of COBE-SST and modification are shown at http://okdk.kishou.go.jp/products/elnino/Announce_200603.pdf. Additionally, at that time the global atmospheric circulation analysis data of the JMA Climate Data Assimilation System (JCDAS), which is the same system as the Japanese 25-year Reanalysis (JRA-25), were operationally introduced (http://jra.kishou.go.jp/index_en.html). Following those above changes and modification, the features of global climate and atmospheric circulation during El Niño/La Niña events were re-investigated using the newly defined both events and datasets of SST and atmospheric circulation.

In this report, the features of global climate, especially Asia, shown in composite maps and of atmospheric circulations regressed on NINO.3 Index during El Niño/La Niña events are outlined in Chapter 2 and 3, respectively.

2. Global Climate

In this Chapter, the characteristics of global temperature and precipitation, particularly in Asia, during El Nino/La Niña events are described based on schematic views derived from three-month mean composites of those elements in respective events in comparison with the neutral phase.

In El Niño events, warm tendencies are found in many areas in the tropics in December-May (Figure 12). In the same period, warm ones are located over Japan except its northern part. Cool tendencies appear from southwestern Japan to eastern China in June-August and over Japan, the Korean Peninsula and northeastern China in September-November (Figure 13). Wet tendencies are found from southwestern Japan to southeastern China in December-February, in northeastern China in March-May, over western Japan and the Korean Peninsula in June-August and in southern China in September-November, while dry tendencies in northern part of China in June-August and across the Korean Peninsula and central China in September-November. Dry tendencies are found in Southeast Asia except June to August.

In La Niña events, cool tendencies are found in southern Asia throughout the year except March-May (Figure 14). Cool tendencies appear in the southern coast of China in December-February and in June-August. Wet tenden-

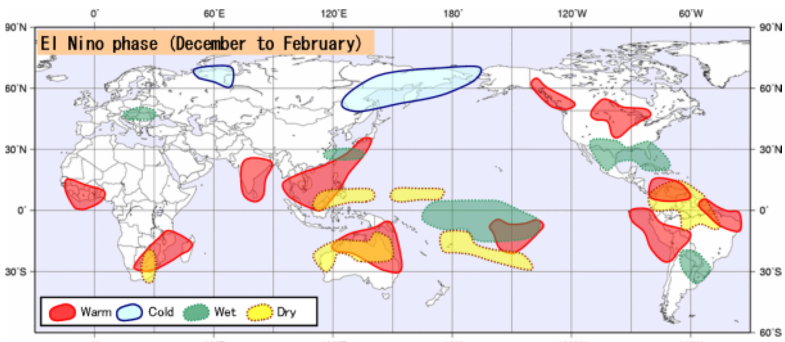


Figure 12 Schematic views of temperature and precipitation during El Niño events (Dec.-Feb.). Map shows statistically significant deviations between normalized temperature anomaly and precipitation ratio in El Niño events and those in the neutral phase. Base period for statistics is 1949-2004.

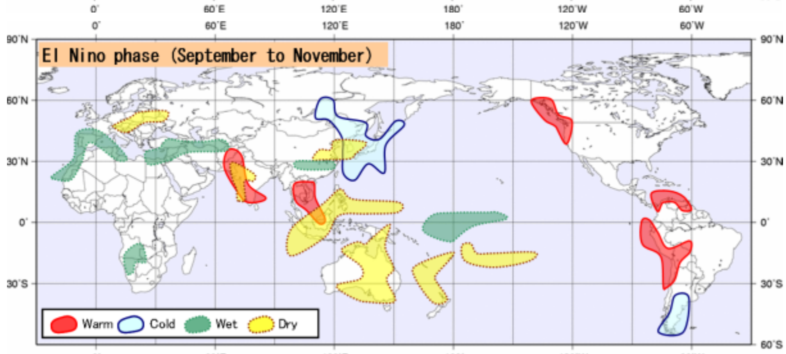


Figure 13 Schematic views of temperature and precipitation during El Niño events (Sep.-Nov.). Same in Figure 12 except for September-November.

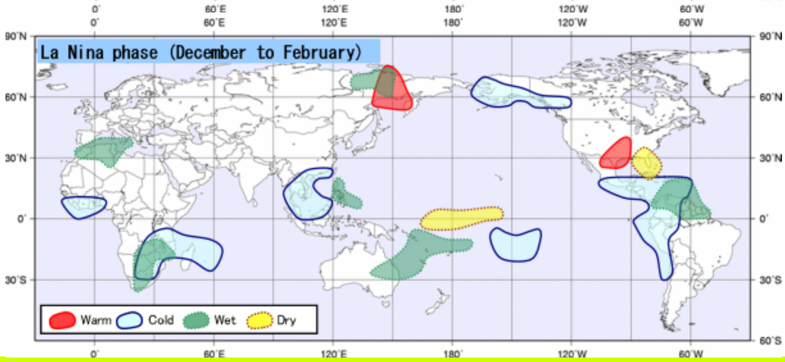


Figure 14 Schematic views of temperature and precipitation during La Niña events (Dec.-Feb.). Same in Figure 12 except for La Niña events.

cies are located in southwestern Japan in June-August, and dry ones from eastern Japan to the eastern coast of China in September-November. Wet tendencies are found over the Philippines in September-February and in Australia in March-May and in September-November.

The detailed description of the methods in producing the composites and used data and all composite maps will be posted on the TCC website in the near future.

3. Atmospheric circulation

In this chapter, the basic features of the relationships between the El Nino monitoring index (NINO.3) and atmospheric circulations are described based on the three month mean regression coefficient maps on the index of +1.0 which can be regarded as ones of typical anomalous circulations during El Niño events.

As to 850 hPa stream function, a couple of cyclonic circulation anomalies are located over both north and south of the equator from the central and eastern Pacific, and anti-cyclonic anomalies are located across the Indian Ocean to Southeast Asia and to Australia. These patterns are found throughout the year especially in boreal winter (Figure 15). 200 hPa stream function shows different sign of anomalies in circulation from 850 hPa stream function over the same regions (Figure 16). Those patterns are consistent with the response to the perturbed equatorial heating (Matsuno, 1966; Gill, 1980).

Regarding 500 hPa height, positive and negative anomalies are found over east of Japan and eastern Siberia, respectively, through boreal autumn and winter, especially from the late autumn to early winter (Figure 17). This anomaly pattern corresponds to so called Western Pacific pattern (Wallace and Gulzler, 1981). Tropical/Northern Hemisphere pattern is found around North America in boreal winter. In the tropics, there broadly exist positive anomalies over the year, especially December to April, reflecting the tropical tropospheric warming related to ENSO (Angell, 2000; Kumar and Hoerling, 2003).

For the detail features of other elements, please refer to the following website;
http://okdk.kishou.go.jp/products/clisys/REGR/readme.html

(*Ayako Takeuchi and Hiroshi Nakamigawa, Climate Prediction Division*)

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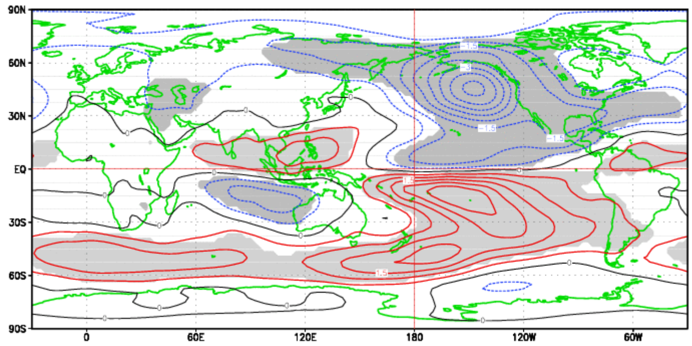

Figure 15 3-Month Mean 850 hPa Stream Function Regression on NINO.3 (Dec.-Feb.).
Red and blue contours show anti-cyclonic and cyclonic circulations, respectively, in the Northern Hemisphere and vice versa in the Southern Hemisphere. Contour interval is 0.5 m^2/s. Shading shows 95% confidence level based on F-test.

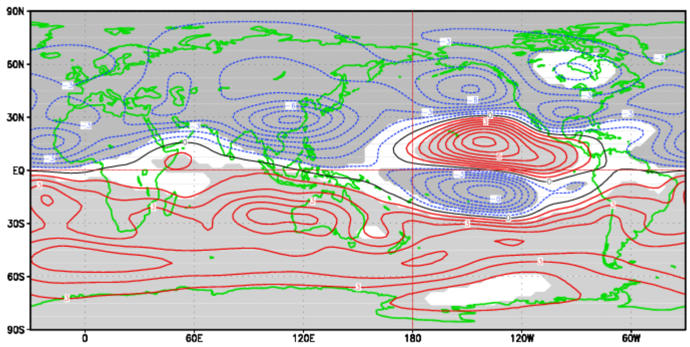

Figure 16 3-Month Mean 200 hPa Stream Function Regression on NINO.3 (Dec.-Feb.).
Same in Figure 15 except that contour interval is 1 m^2/s.

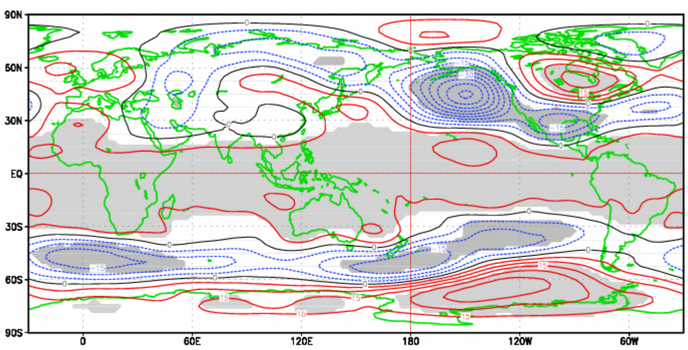

Figure 17 3-Month Mean 500 hPa Height Regression on NINO.3 (Dec.-Feb.).
Same in Figure 15 except that contour interval is 5 m.

Participant's Report on the WMO Conference "*Living with Climate Variability and Change: Understanding the Uncertainties and Managing the Risks*"

This conference was held by World Meteorological Organization (WMO) and co-hosted by Finnish Meteorological Institute (FMI) and International Research Institute for Climate and Society (IRI) in Espoo, Finland on 17-21 July 2006. Over 250 participants gathered around the world from the operational NMHSs, international institutions such as UNDP, WHO, FAO, UNESCO, World Bank etc., universities and research institutes, and private companies. All of them are interested in risk management and concerned about climate variability and change. The author, who attended the conference, reports the summary and his impression below.

The outcomes of this conference are summarized as follows:

1) It was recognized that the climate variability and change are strongly affecting politics and economies through bringing poverty, triggering economical crises and damaging social capital;
2) It was agreed that it's necessary for us to develop a "climate-related risk management" technique, that is, to construct social scientific models, which include the assessment of risks due to climate variability/change and the incorporation of climate predictions/projections into the practical decision-making processes, in order to mitigate the climate-related hazards and losses; and
3) It was agreed that it's quite important that not only the weather/climate data but also the socioeconomic and environmental data are exchanged smoothly to develop a climate-related risk management technique, and it was stressed that we should make more efforts to build bridges between climate and social science, scientists and practitioners, public and private sectors, and also among international institutions.

Based on the above recognition and agreements, the "Espoo statement" was drafted by the chairs and adopted by the participants, in which it was recommended to develop collaborative mechanisms that facilitate client-driven activities in and enhance the awareness of the climate-related risk management. The statement is going to be deliberated at the WMO Congress in 2007 to be adopted as a recommendation to the member governments. It is supposed to be submitted to the third World Climate Conference which is planned to be hold in 2008, too. (The "Espoo statement" and the presentations are available at the Conference website: http://www.livingwithclimate.fi/)

This conference focused on four major climate-sensitive sectors and two related sectors. Those were "agriculture and food security", "water resources", "human health and disease control", "energy and the built environment" (another climate-sensitive sector "tourism" was treated in the "energy and the built environment" sub-session), "disaster and early warning" and "decision making research". After the keynote lectures on each sector in the plenary session, sector-specific activities, problems and some cross-cutting issues were reported and discussed in the break-out sessions.

In the poster session, I presented two activities for developing applications of climate information at JMA. One was the simulation experiment which was intended to evaluate the value of the special weather information for agricultural sector based on the probability assessment by the medium-range ensemble prediction system. The other was the development of the "early warning of unusual weather", which aims to provide the early warning of unusual temperature (very hot/ very cold) about two weeks in advance based on the probability assessment by the extended ensemble prediction system (link to the presentation: http://okdk.kishou.go.jp/library/LWCVC_2006.html). The chair of the "decision making" sector said that it was absolutely necessary to execute simulation experiments, which operate the decision-making system with inputs taken from the forecast/hindcast data, as we did at JMA, in order to estimate the economical value of the climate prediction and to improve the decision-making system. I felt that we should carry on our efforts in this correct direction.

I participated in the "disaster and early warning" sub-session, where it was stressed that a weather/climate observation/analysis/prediction system, which weather/climate scientists have successfully developed so far, was nothing more than one component of an integrated early warning system. The integrated early warning system, which works effectively for disaster prevention/mitigation, should include assessment of the potential risks of weather/climate-related disasters on the knowledge of the societal vulnerability, an institutional framework or mechanism for effective dissemination and communication to the public or end-users, and building up the awareness of climate-risks and the preparedness for natural disasters among the inhabitants (Figure 18). JMA is developing the "early warning of unusual weather" system which will provide the probabilistic prediction of unusual weather at arbitrary thresholds. I felt we should pay more attention to the following factors: 1) referring to the risk of disaster based on the mapping of the probability of unusual weather and the societal vulnerability, 2) establishing the effective and clear way of communication which is designed to avoid misunderstanding, 3) in-

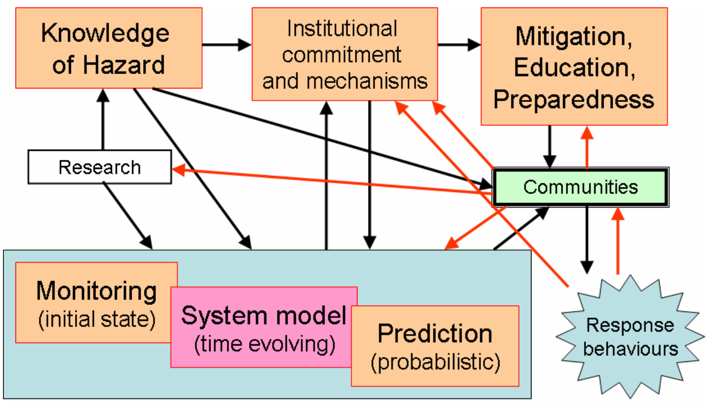

Figure 18 Components of Integrated Early Warning System (boxes) and flow of the information (arrows). Red arrows mean that they are particularly important and should be promoted. The figure is quoted from the presentation by Reid Basher, ISDR Secretariat and ISDR Platform for Promotion of Early Warning.

corporating the weather/climate information into the practical decision-making system.

In the discussion of the cross-cutting matters, many presenters pointed out that the availability of the necessary data, both meteorological/hydrological and societal/economic, should be improved in order to promote the development and evaluation of the climate risk management support system. And it was equally stressed that the development should be driven by the users' requirement, because the societal value of the climate information was properly evaluated only by its users, in other words, there was no use if it could not be applied in real decision making. So we should try to build bridges between the weather/climate scientists and the stakeholders in various sectors, and hear what they really need. I think those efforts will make the climate information truly valuable for the human welfare.

(*Shingo Yamada, Climate Prediction Division*)

Minimum in Record of Total Ozone at Syowa Station, Antarctica

In 2006, the Antarctic ozone hole developed to the maximum level in record, and total ozone observed at Syowa Station, Antarctica, was the minimum in record.

1. The situation of Antarctic ozone hole this year

According to the observation conducted by the 47th Japanese Antarctic Research Expedition (JARE-47) at Syowa Station in the 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 (Figure 19), which is less than half the average before 1980 when the ozone hole didn't appear yet.

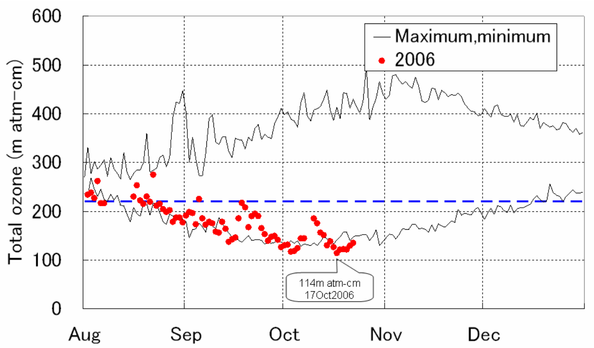

Figure 19 Annual variation in total ozone at Syowa Station in the Antarctica (until 22 October).
Black lines show daily maximum and minimum values since

According to the satellite observation by the NASA, the Antarctic ozone hole in the stratospheric ozone layer, defined as the area of the total ozone of 220 m atm-cm or below, developed to its maximum level as follows:

Area: 29.3 million km^2 (the second largest, only next to 2000)

Deficit: 105 million tons (the second largest, only next to 2003)

Related figures can be referred to at the following:

http://okdk.kishou.go.jp/news/topics_20061011.html

2. Reasons for this development of the Antarctic ozone hole

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 ℃ 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.

(*Toru Sasaki, Ozone Layer Monitoring Office*)

New Atmospheric Circulation Climatological Normal derived from JRA-25 data and its Atlas

Since recently JMA has prepared the new climatological normal of atmospheric circulations derived from the Japanese 25-year Reanalysis (JRA-25) data (http://jra.kishou.go.jp/index_en.html) for climate system monitoring, it will use the new normal in issuing all the atmospheric circulation monitoring products for this November, together with the atmospheric circulation analysis data of the JMA Climate Data Assimilation System (JCDAS) dataset which has been operationally produced with the same system as the JRA-25 and used since this March. Accordingly, the normal is consistent in quality with the analysis, so that it is expected that fake anomalies caused by the difference between the assimilation systems for the analysis and normal will disappear and the reliability of the monitoring products will be improved. The base period for the new normal of the atmospheric circulations is 1979-2004. At the same time, the base period for the normal of OLR used at the JMA will be adjusted to the period of the atmospheric circulation normal. On the TCC website, the products using the new normal will be placed from this December. "Monthly report on Climate System Separate Volume No.13" will be issued this December, in which the documents on the calculation methods and characteristics, figures and GPV data of the new normal are contained.

Don't miss it!

(*Hiroshi Nakamigawa, Climate Prediction Division*)

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: Shingo Yamada)

Tokyo Climate Center (TCC), Climate Prediction Division, JMA
Address: 1-3-4 Otemachi, Chiyoda-ku, Tokyo 100-8122, Japan
TCC website: http://okdk.kishou.go.jp/index.html