

Training Seminar on Climate Information and Forecasting
4th November 2008



Techniques for Climate System Monitoring

4th November, 2008

Yayoi Harada
Climate Prediction Division/JMA





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1. Outline of CPD's Climate Diagnostics
2. Report on the tropical convection and large scale circulation in September
3. Report on the extra-tropical atmospheric circulation in September 2008 (briefly)



1. Monthly Highlights on Climate System

<http://ds.data.jma.go.jp/tcc/tcc/index.html>

1. Monthly Highlights on Climate System



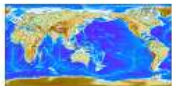
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Main Products

Climate in the World
Climate System Monitoring
El Niño Monitoring
NWP Model Prediction
Global Warming
Climate and Outlook in Japan

ClimatView



GPC Long-range
forecast (LRF) Products



TCC News (latest
issue)



Monthly Highlights on
Climate System (latest
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Main Products

Climate in the World

Climate System Monitoring

▶ Monthly Highlights on
Climate System (14 Oct 2008)

▶ Pentad for Asia

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▶ Monthly Report

Ex-Trop : Trop

▶ Seasonal Highlight

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▶ Stratospheric Monitoring

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El Niño Monitoring

NWP Model Prediction

Global Warming

Climate and Outlook in Japan

27 May 2008

▶ TCC News No. 12 (Spring 2008): Published

26 March 2008

▶ JMA and CRIEPI publish "JRA-25 Atlas"
- "JRA-25 Atlas" website launched

21 March 2008

▶ New Information available: Early

21 March 2008

▶ Announcement: JMA's one-month prediction model upgraded

28 February 2008

▶ All Figures and Tables from 1979 onwards available: Atmospheric Circulation Maps, Cross

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Monthly Highlights on Climate System

Explanatory Notes

Highlights in September 2008

- Monthly precipitation amounts were significantly below normal in Northern Japan, while significantly above normal in Okinawa/Amami.
- Monthly mean temperatures were extremely high in southern China and from the Middle East to northern Africa.
- Damage from hurricanes was reported around the Caribbean countries.
- A blocking high over northern Europe and a trough over northern Canada developed and persisted.
- Convective activities were enhanced near the Philippines and over eastern Indonesia, and suppressed over the equatorial Indian Ocean.
- Negative SST anomalies were found in the central equatorial Pacific, and positive SST anomalies were found in the western and eastern parts.

Full version (PDF)

Monthly Highlights on Climate System (September 2008)

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1. Monthly Highlights on Climate System

15 October, 2008 Japan Meteorological Agency

Monthly Highlights on Climate System (September 2008)

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Japan

Monthly mean temperatures were above normal all over Japan. Precipitation tended to be above normal in Northern Japan, and the highest record for rainfall amounts of the Sea of Japan side of Northern Japan since 1946 was broken. Two typhoons (Gladys and Fengal) struck Okinawa/Amami, and brought noticeable heavy rainfall and strong wind to Okinawa/Amami, monthly precipitation amount was significantly above normal and monthly sunshine duration was significantly below normal.

World Climate

The amount of the monthly global average surface precipitation in September 2008 was +1.24°C (9th highest since 1870) (Fig. 2). In a longer time scale, the global

World Climate

mean surface temperature anomaly in September over the globe. This indicates a moderate of surface temperature for each year. This indicates a long-term trend. Anomalous are defined as the deviation

15 October, 2008

Japan Meteorological Agency

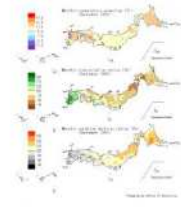


Fig. 1 Monthly climate anomaly/ratio over Japan (September 2008)

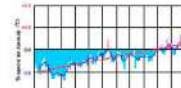


Fig. 2 Long-term changes in monthly mean surface temperature anomaly in September over the globe. This indicates a moderate of surface temperature for each year. This indicates a long-term trend. Anomalous are defined as the deviation

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Climate in Japan

World Climate

Extrotropics

Tropics

Oceanographic conditions

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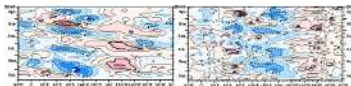


Fig. 7 Time-longitude cross section (10°N-10°S) of 8-day mean 200 hPa velocity potential anomaly (vectors) and 600 hPa wind anomaly (vectors) (April - September 2008). Contour interval is 2x10⁶ m²/s (left) and 2 m/s (right). Area period for the annual is 1979-2004.

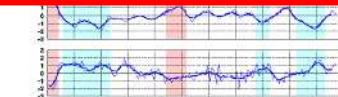


Fig. 8 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate post-20-year mean SST, averaged over the Niño-3.4 region (August). Time series of the SOUTHERN OCEAN INDEX with respect to the 1971-2000 base period (SOI). The blue line represent monthly mean, and thick blue line 7-month running mean. Points of El Niño and La Niña events are shown in red colored and blue colored lines, respectively.

Detailed information on the climate system is available on the Tokyo Climate Center's website (<http://data.jma.go.jp/frcgc/research/>). This report is prepared by the Climate Prediction Division, Global Earthsystem and Monitor Department, Japan Meteorological Agency.

1. Monthly Highlights on Climate System

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Japan Meteorological Agency

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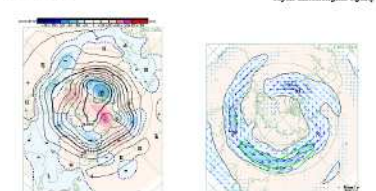


Fig. 4 Monthly mean 500 hPa height and anomaly in the Northern Hemisphere (September 2008). Contours show height at an interval of 60 m. Shaded regions show height anomalies. Base period for the normal is 1979-2004.

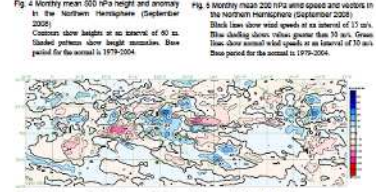


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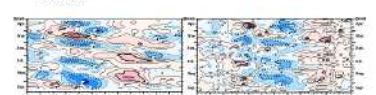


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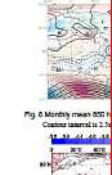


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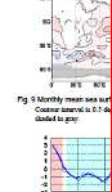


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associated with the blocking high over northern Europe.

Tropics (Figs. 6, 7 and 8):

Convective activities were enhanced near the Philippines and over eastern Indonesia, and suppressed over the equatorial Indian Ocean (Fig. 6). Convections were activated in the western Atlantic and Gulf of Mexico due to the passage of hurricanes. In the lower troposphere, the subtropical high was stronger than its normal over the northwestern Pacific and remarkable easterly anomalies were observed near the equator from the western to central Pacific (Fig. 8). In the first half of September, the active phase of the Madden-Julian Oscillation (MJO) propagated eastward from the Indian Ocean to Indonesia (Fig. 7). Convections were activated in Asian monsoon region and enhanced convection area moved northward. In the second half of September, the active phase of the MJO propagated from Indonesia to the western hemisphere though its eastward propagation became obscure temporarily.

Oceanographic Conditions (Figs. 9 and 10):

Negative SST anomalies were found in the central equatorial Pacific, and positive SST anomalies were found in the western and eastern parts. The monthly mean SST anomaly was $+0.2^{\circ}\text{C}$ in the NINO.3 region ($+0.2^{\circ}\text{C}$ deviated from the latest sliding 30-year mean SST for the same region (Fig.10)).

In the North Pacific, negative SST anomalies were found from around 10°N , 160°E to the west of Mexico, to the south of Alaska and in the vicinity of the west coast of North America. Positive SST anomalies were found in the western tropical region to the south of Japan, to the north of 30°N in the western North Pacific, and from 25°N , 170°W to 40°N , 140°W . In the South Pacific, positive SST anomalies were found from New Guinea Island to 35°S , 130°W .

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In the Indian Ocean, positive SST anomalies were broadly found in the central tropical region.

* Federal Emergency Management Agency of the United States

1. Monthly Highlights on Climate System

World Climate (Fig. 2)

The anomaly of temperature in September since 1891) (Fig. 2) average surface temperature about 0.57°C per 100

- Monthly mean temperature in southern China and Africa (Fig.3).
- Monthly precipitation around the eastern and above normal low precipitation.
- In the Caribbean and fatalities due to reported by MOFA

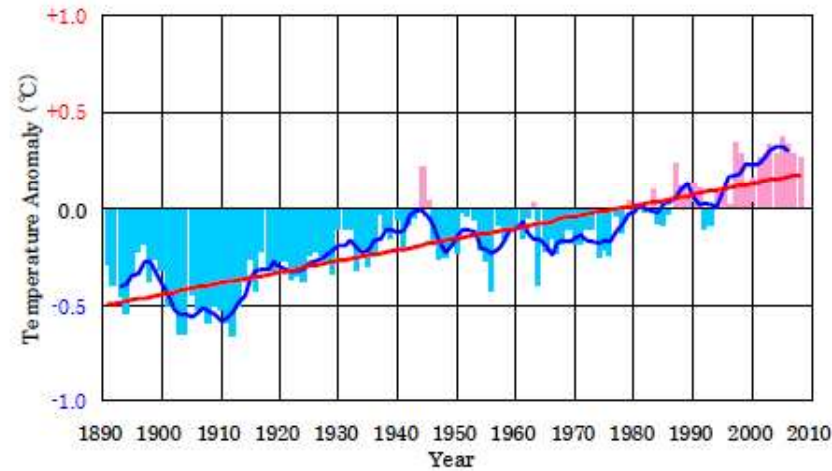


Fig. 2 Long-term changes in monthly mean surface temperature anomaly in September over the globe
Bars indicate anomalies of surface temperature for each year. Blue line indicates 5-year running means, and red line indicates a long-term linear trend. Anomalies are defined as the deviations from the normal (1971-2000 average).

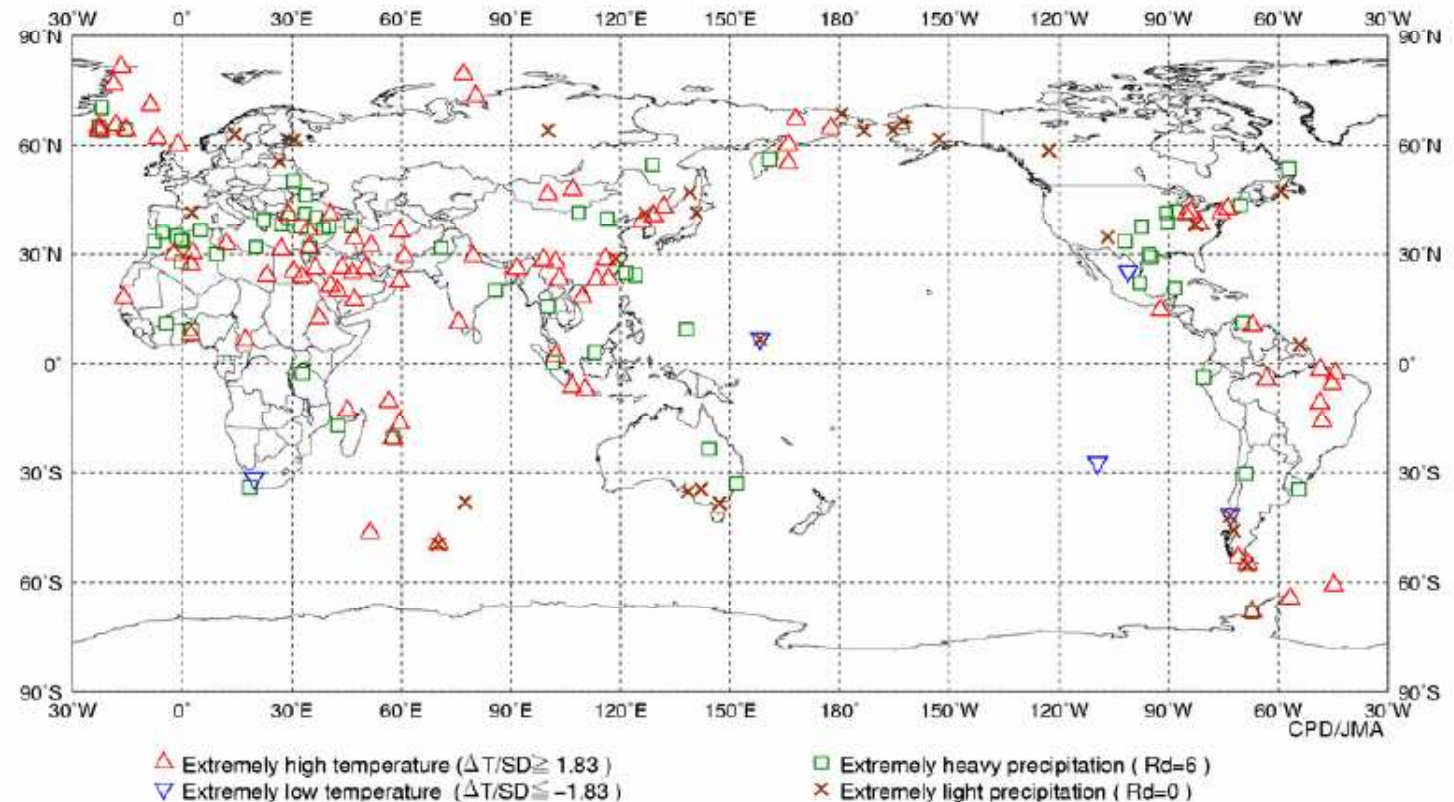


Fig. 3 Distribution of extreme climate events (September 2008)

1. Monthly Highlights on Climate System

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Monthly Highlights on Climate System (September 2008)

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In the 500-hPa height field, positive anomalies were observed in northern Europe due to the development and persistence of a blocking high in mid-September (Fig. 4). At the same time, a trough developed and persisted over northern Canada. In relation to this, the jet stream from North America to the Atlantic was stronger than its normal (Fig. 5). Meanwhile, the sub-tropical jet and the polar front jet were separated widely over Europe. In addition, both the rate of the polar front jet and the active region of high frequency disturbances over Europe shifted northward.

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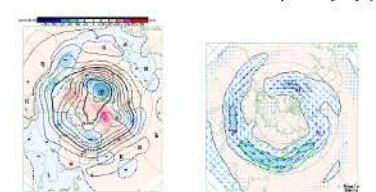


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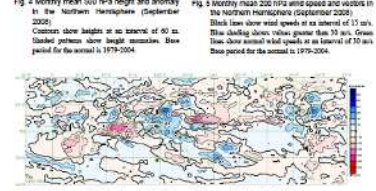


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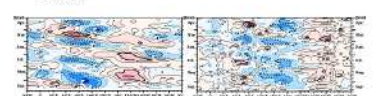


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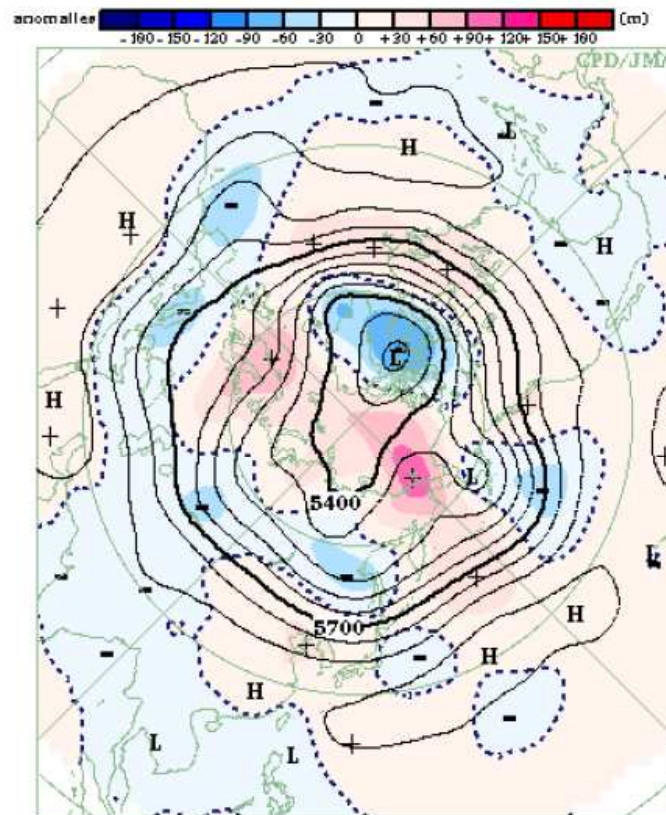


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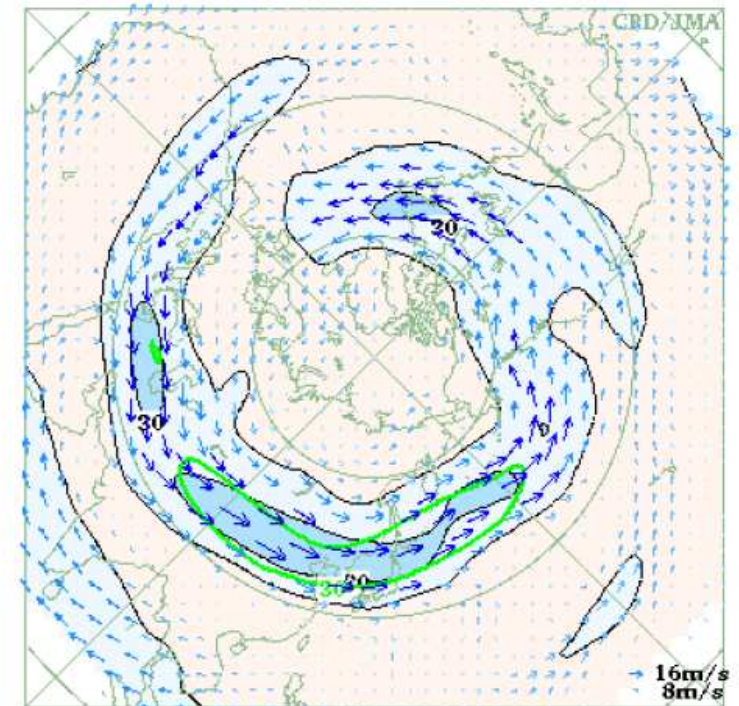


Fig. 5 Monthly mean 200 hPa wind speed and vectors in the Northern Hemisphere (September 2008)
Black lines show wind speeds at an interval of 15 m/s. Blue shading shows values greater than 30 m/s. Green lines show normal wind speeds at an interval of 30 m/s. Base period for the normal is 1979-2004.

1. Monthly Highlights on Climate System

15 October, 2008
Japan Meteorological Agency

Monthly Highlights on Climate System (September 2008)

Highlights in September 2008

- Monthly precipitation amounts were significantly below normal in Northern Japan, while significantly above normal in Okinawa/Amami.
- Monthly mean temperatures were extremely high in southern China and from the Middle East to northern Africa.
- Damage from hurricanes was reported around the Caribbean countries.
- A blocking high over northern Europe and a trough over northern Canada developed and persisted.
- Convective activities were enhanced near the Philippines and over eastern Indonesia, and suppressed over the equatorial Indian Ocean.
- Negative SST anomalies were found in the central equatorial Pacific, and positive SST anomalies were found in the western and eastern parts.

Climate in Japan (Fig. 1):

Fig. 1

Monthly mean temperatures were above normal all over Japan. Anticyclones tended to cover around Northern Japan from early to mid-September. As a result, monthly precipitation amounts were significantly below normal in Northern Japan, and the highest record for sunshine duration of the Sea of Japan side of Northern Japan since 1946 was broken. Two typhoons (Sinlaku and Jangmi) struck Okinawa/Amami, and brought recordable heavy rainfall and strong wind. In Okinawa/Amami, monthly precipitation amounts were significantly above normal and monthly sunshine duration was significantly below normal.

World Climate (Figs. 2 and 3):

Fig. 2

The anomaly of the monthly global average surface temperature in September 2008 was $+0.26^{\circ}\text{C}$ (9th highest since 1891) (Fig. 2). In a longer time scale, the global average surface temperature has been rising at a rate of about 0.57°C per 100 years.

Oceanographic Conditions (Figs. 6, 7 and 8):

Fig. 6

Monthly mean temperatures were extremely high in southern China and from the Middle East to northern Africa (Fig. 6).

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- Monthly mean temperatures were extremely high in southern China and from the Middle East to northern Africa (Fig. 3).
- Monthly precipitation amounts were extremely heavy around the eastern and southern Mediterranean Sea due to above normal low pressure system activity.
- In the Caribbean countries and the USA, more than 200 fatalities due to hurricane "Hanna" and "Ike" were reported by MOFA of Japan and FEMA*.

Extratropics (Figs. 4 and 5):

In the 500-hPa height field, positive anomalies were observed in northern Europe due to the development and persistence of a blocking high in mid-September (Fig. 4). At the same time, a trough developed and persisted over northern Canada. In relation to this, the jet stream from North America to the Atlantic was stronger than its normal (Fig. 5). Meanwhile, the sub-tropical jet and the polar front jet were separated widely over Europe. In addition, both the axis of the polar front jet and the active region of high frequency disturbances over Europe shifted northward

Tropics

Tropics (Figs. 6, 7 and 8):

Convective activities were enhanced near the Philippines and over eastern Indonesia, and suppressed over the equatorial Indian Ocean (Fig. 6). Convections were activated in the western Atlantic and Gulf of Mexico due to the passage of hurricanes. In the lower troposphere, the subtropical high was stronger than its normal over the northwestern Pacific and remarkable easterly anomalies were observed near the equator from the western to central Pacific (Fig. 8). In the first half of September, the active phase of the Madden-Julian Oscillation (MJO) propagated eastward from the Indian Ocean to Indonesia (Fig. 7). Convections were activated in Asian monsoon region and enhanced convection area moved northward. In the second half of September, the active phase of the MJO propagated from Indonesia to the western hemisphere though its eastward propagation became obscure temporarily.

Oceanographic Conditions (Figs. 9 and 10):

Negative SST anomalies were found in the central equatorial Pacific, and positive SST anomalies were found in the western and eastern parts. The monthly mean SST anomaly was $+0.2^{\circ}\text{C}$ in the NINO.3 region ($+0.2^{\circ}\text{C}$ deviated from the latest sliding 30-year mean SST for the same region (Fig.10)).

In the North Pacific, negative SST anomalies were found from around 10°N , 160°E to the west of Mexico, to the south of Alaska and in the vicinity of the west coast of North America. Positive SST anomalies were found in the western tropical region to the south of Japan, to the north of 30°N in the western North Pacific, and from 25°N , 170°W to 40°N , 140°W . In the South Pacific, positive SST anomalies were found from New Guinea Island to 35°S , 130°W .

In the Atlantic, positive SST anomalies were found in the tropical region and to the north of 30°N except the west of Britain.

In the Indian Ocean, positive SST anomalies were broadly found in the central tropical region.

* Federal Emergency Management Agency of the United States

1. Monthly High

Tropics (Figs. 6, 7 and 8):

Convective activities were enhanced over eastern Indonesia, and the equatorial Indian Ocean (Fig. 6). Convection was also activated in the western Atlantic and the Caribbean Sea during the passage of hurricanes. In the northern hemisphere, the subtropical high was stronger than normal over the northwestern Pacific and remarkable negative OLR anomalies were observed near the equator from the Indian Ocean to the Pacific (Fig. 8). In the first half of September, the active phase of the Madden-Julian Oscillation (MJO) moved eastward from the Indian Ocean to the Pacific. In the second half of September, the active phase of the MJO moved from Indonesia to the western Pacific, and the eastward propagation became obscured.

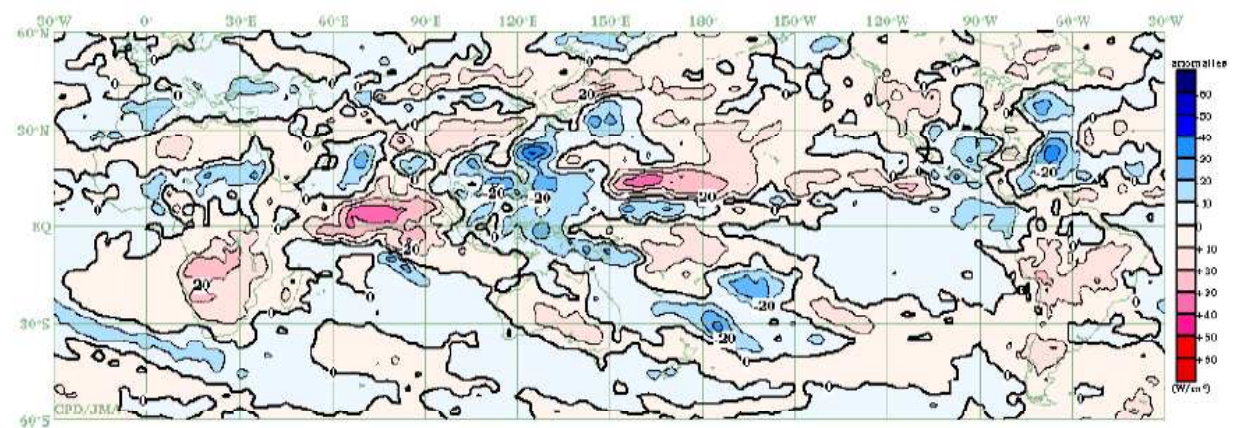


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (September 2008)

Contour interval is 10 W/m^2 . Base period for the normal is 1979-2004. Original data are provided by courtesy of CDC/NOAA.

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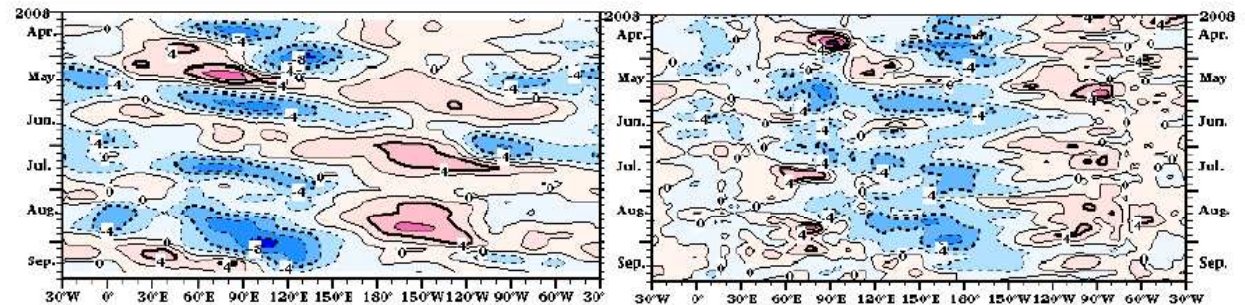


Fig. 7 Time-Longitude cross section (5°N - 5°S) of 5-day mean 200 hPa velocity potential anomaly (left) and 850 hPa zonal wind anomaly (right) (April – September 2008)

Contour interval is $2 \times 10^6 \text{ m}^2/\text{s}$ (left) and 2 m/s (right). Base period for the normal is 1979-2004.

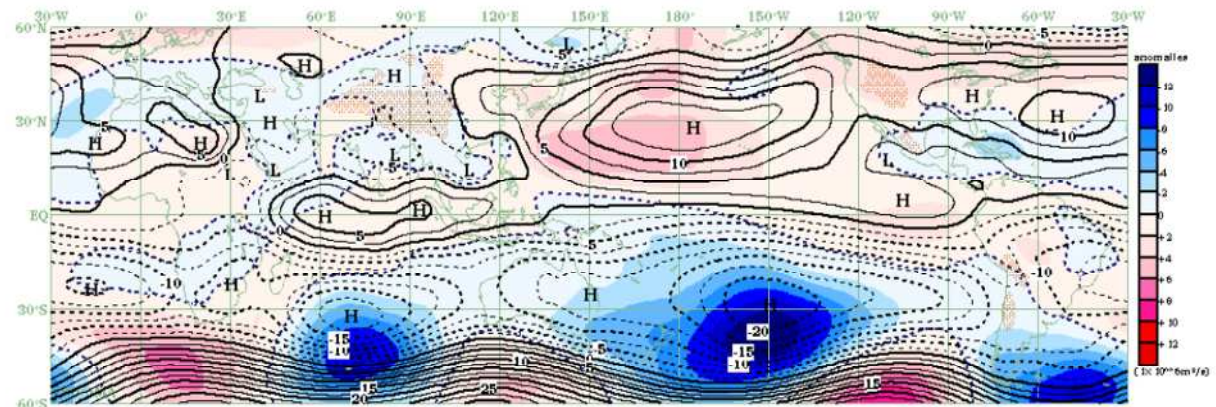


Fig. 8 Monthly mean 850 hPa stream function and anomaly (September 2008)

Contour interval is $2.5 \times 10^6 \text{ m}^2/\text{s}$. Base period for the normal is 1979-2004.

1. Monthly Highlights on Climate System

15 October, 2008

Japan Meteorological Agency

Monthly Highlights on Climate System (September 2008)

Highlights in September 2008

- Monthly precipitation amounts were significantly below normal in Northern Japan, while significantly above normal in Okinawa/Amami.
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Monthly mean temperatures were above normal all over Japan. Anticyclones tended to cover around Northern Japan from early to mid-September. As a result, monthly precipitation amounts were significantly below normal in Northern Japan, and the highest record for sunshine duration of the Sea of Japan side of Northern Japan since 1946 was broken. Two typhoons (Sinlaku and Jangmi) struck Okinawa/Amami, and brought recordable heavy rainfall and strong wind. In Okinawa/Amami, monthly precipitation amounts were significantly above normal and monthly sunshine duration was significantly below normal.

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15 October, 2008

Japan Meteorological Agency

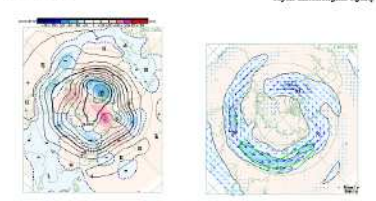


Fig. 4 Monthly mean 500 hPa height and anomaly in the Northern Hemisphere (September 2008). Contours show height at an interval of 60 m. Shaded regions show height anomalies. Blue/pink for the normal is 1979-2004.



Fig. 5 Monthly mean 200 hPa wind speed and vectors in the Northern Hemisphere (September 2008). Black lines show wind speed at an interval of 10 m/s. Shaded regions show wind speed anomalies. Blue/pink for the normal is 1979-2004.

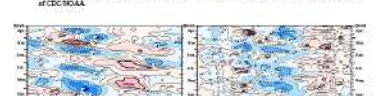


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (September 2008). Contours interval is 10 W/m². Shaded regions show OLR anomalies. Blue/pink for the normal is 1979-2004.



Fig. 7 Time-longitude cross section (10°N-40°N) of 5-day mean 200 hPa velocity potential anomaly (vectors) and 500 hPa wind and anomaly (vectors) (April - September 2008). Contours interval is 200 m²/s, and 10 m/s (vectors). Shaded regions show wind speed anomalies. Blue/pink for the normal is 1979-2004.

15 October, 2008

Japan Meteorological Agency

Highlights in September 2008

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15 October, 2008

Japan Meteorological Agency



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Fig. 9 Monthly mean 200 hPa wind speed and vectors in the Northern Hemisphere (September 2008). Black lines show wind speed at an interval of 10 m/s. Shaded regions show wind speed anomalies. Blue/pink for the normal is 1979-2004.



Fig. 10 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (September 2008). Contours interval is 10 W/m². Shaded regions show OLR anomalies. Blue/pink for the normal is 1979-2004.

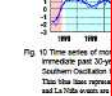


Fig. 11 Time-longitude cross section (10°N-40°N) of 5-day mean 200 hPa velocity potential anomaly (vectors) and 500 hPa wind and anomaly (vectors) (April - September 2008). Contours interval is 200 m²/s, and 10 m/s (vectors). Shaded regions show wind speed anomalies. Blue/pink for the normal is 1979-2004.



Fig. 12 Time-longitude cross section (10°N-40°N) of 5-day mean 200 hPa velocity potential anomaly (vectors) and 500 hPa wind and anomaly (vectors) (April - September 2008). Contours interval is 200 m²/s, and 10 m/s (vectors). Shaded regions show wind speed anomalies. Blue/pink for the normal is 1979-2004.

Climate in Japan (Fig. 1):

Monthly mean temperatures were above normal all over Japan. Anticyclones tended to cover around Northern Japan from early to mid-September. As a result, monthly precipitation amounts were significantly below normal in Northern Japan, and the highest record for sunshine duration of the Sea of Japan side of Northern Japan since 1946 was broken. Two typhoons (Sinlaku and Jangmi) struck Okinawa/Amami, and brought recordable heavy rainfall and strong wind. In Okinawa/Amami, monthly precipitation amounts were significantly above normal and monthly sunshine duration was significantly below normal.

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associated with the blocking high over northern Europe.

Tropics (Figs. 6, 7 and 8):

Convective activities were enhanced near the Philippines and over eastern Indonesia, and suppressed over the equatorial Indian Ocean (Fig. 6). Convections were activated in the western Atlantic and Gulf of Mexico due to the passage of hurricanes. In the lower troposphere, the subtropical high was stronger than its normal over the northwestern Pacific and remarkable easterly anomalies were observed near the equator from the western to central Pacific (Fig. 8). In the first half of September, the active phase of the Madden-Julian Oscillation (MJO) propagated eastward from the Indian Ocean to Indonesia (Fig. 7). Convections were activated in Asian monsoon region and enhanced convection area moved northward. In the second half of September, the active phase of the MJO propagated

Oceanographic conditions

Oceanographic Conditions (Figs. 9 and 10):

Negative SST anomalies were found in the central equatorial Pacific, and positive SST anomalies were found in the western and eastern parts. The monthly mean SST anomaly was $+0.2^{\circ}\text{C}$ in the NINO.3 region ($+0.2^{\circ}\text{C}$ deviated from the latest sliding 30-year mean SST for the same region (Fig. 10)).

In the North Pacific, negative SST anomalies were found from around 10°N , 160°E to the west of Mexico, to the south of Alaska and in the vicinity of the west coast of North America. Positive SST anomalies were found in the western tropical region to the south of Japan, to the north of 30°N in the western North Pacific, and from 25°N , 170°W to 40°N , 140°W . In the South Pacific, positive SST anomalies were found from New Guinea Island to 35°S , 130°W .

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* Federal Emergency Management Agency of the United States

1. Monthly

Oceanographic Conditions (Fig. 9)

Negative SST anomalies were found in the equatorial Pacific, and positive anomalies were found in the western and eastern part of the Pacific. The maximum negative anomaly was -0.2°C in the central equatorial Pacific, and the maximum positive anomaly was $+0.2^{\circ}\text{C}$ in the western equatorial Pacific. The SST anomalies deviated from the latest sliding mean of the same region (Fig.10)).

In the North Pacific, negative anomalies were found from around 10°N , 160°E to the south of Alaska and in the vicinity of North America. Positive SST anomalies were found in the western tropical region to the south of 30°N in the western North Pacific to 40°N , 140°W . In the Southern Ocean, negative anomalies were found from New Zealand to 130°W .

In the Atlantic, positive SST anomalies were found in the tropical region and to the north of Britain.

In the Indian Ocean, positive anomalies were found in the central tropical

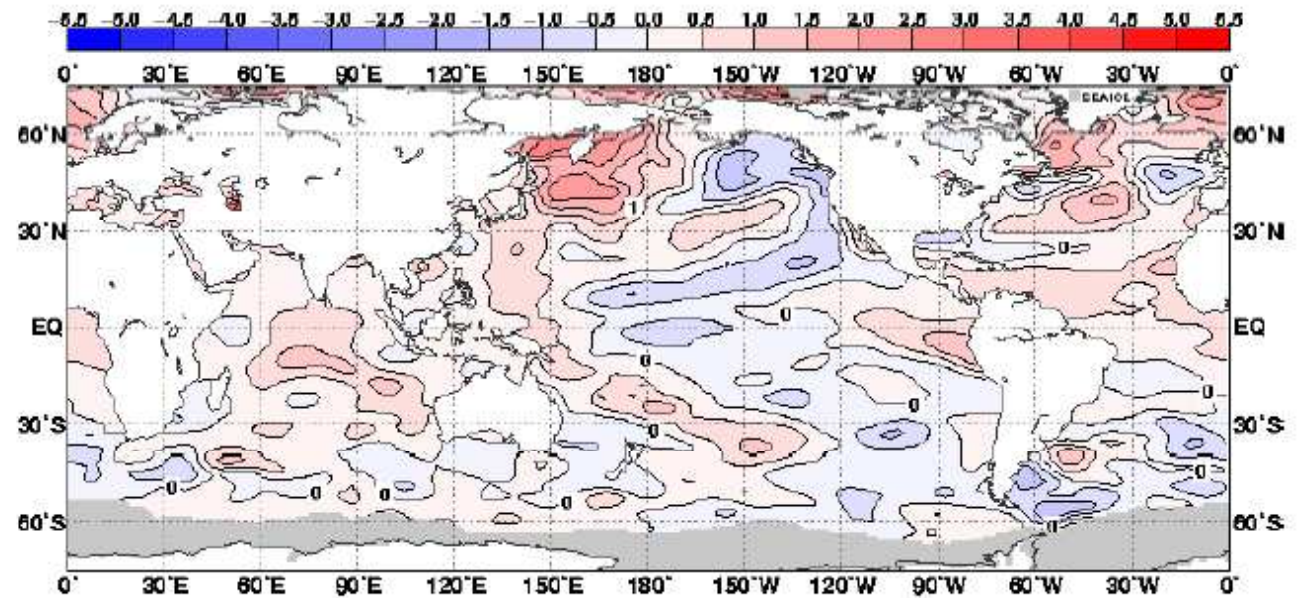


Fig. 9 Monthly mean sea surface temperature anomaly (September 2008)

Contour interval is 0.5 degree C. Base period for the normal is 1971-2000. Maximum coverage with sea ice is shaded in gray.

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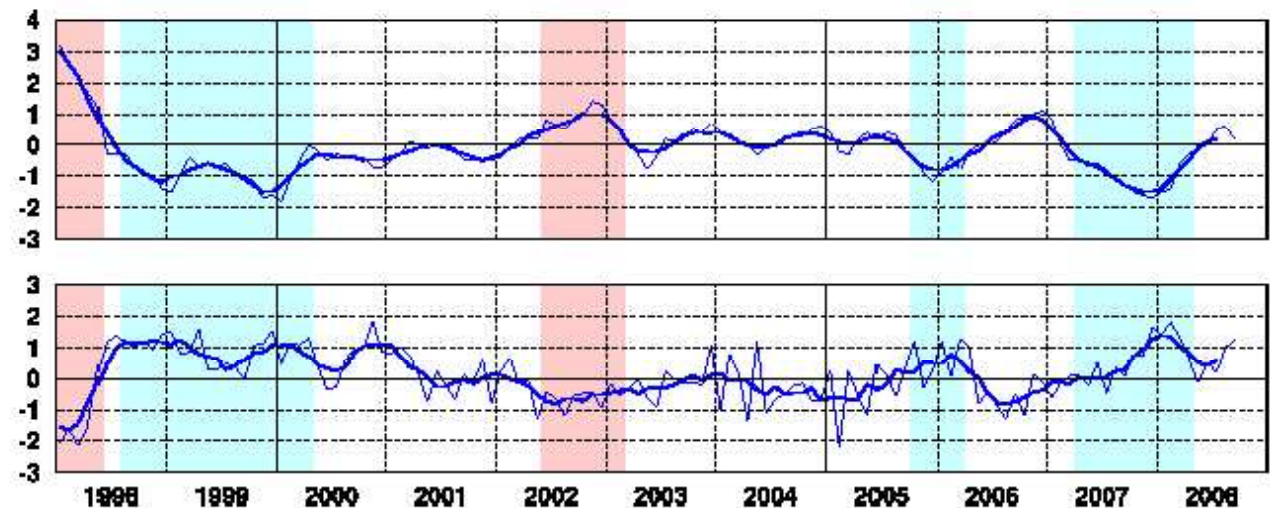


Fig. 10 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST, averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1971-2000 base period (lower).

Thin blue lines represent monthly means, and thick blue lines 5-month running means. Periods of El Niño and La Niña events are shown as red-colored and blue-colored boxes, respectively.

3



2. Report on Climate System

<http://ds.data.jma.go.jp/tcc/tcc/index.html>

2. Report on Climate System

Tokyo Climate Center Home Page - Microsoft Internet Explorer

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Main Products

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- Climate System Monitoring**
- El Niño Monitoring
- NWP Model Prediction
- Global Warming
- Climate and Outlook in Japan

What's New

27 October 2008 / **NEW**
Annual Report on Climate System 2007

14 October 2008 / **NEW**
Annual Report on Climate System 2007

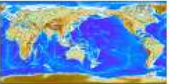
Links

- WMO DDB (Various Climate-related Products and Data)
- Monthly Climate Statistics for Japan
- Satellite Imagery of MTSAT-1R
- Tropical Cyclone Advisory : Tokyo Typhoon Center
- Japanese 25-year Reanalysis Project (JRA-25)
- JRA-25 Atlas / **NEW**
- World Data Center for Greenhouse Gases (WDCGG)
- RSMC Tokyo - Typhoon Center
- Meteorological Research Institute, JMA
- Meteorological Satellite Center, JMA
- World Meteorological Organization (WMO)
- GCOS Surface Network Monitoring Center (GSNMC)
- Beijing Climate Center
- APEC Climate Center
- Korea Meteorological Administration
- Asian Disaster Reduction Center
- Severe Weather Information Center
- World Weather Information Service


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 - Pentad for Asia (01 Nov 2008)
 - Monthly for Asia (01 Nov 2008)
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GPC Long-range forecast (LRF) Products



TCC News (latest issue)



Monthly Highlights on Climate System (latest issue)



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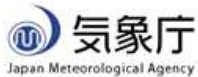
http://ds.data.jma.go.jp/tcc/tcc/index.html



3. Asian monsoon monitoring

3. Asian Monsoon Monitoring

Climate System Monitoring / TCC - Micro
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HOME > Climate System Monitoring

Climate System Monitoring

JMA monitors the present state of the global ocean conditions and snow/ice coverage and provides useful information for interpretation of the scientific research. Noting that homogeneous and consistent Reanalysis Project (JRA-25) in cooperation with March 2006, and long-term, homogeneous reanalysis operated the JMA Climate Data Assimilation Project on a basis since March 2006.

The normal was replaced by a new one based on the MRCSS Separated Volume No.13 published in 2006. >> Outlines of the New Atmospheric Circulation

Main Products

Report on Climate System

Monthly features of extratropical circulation&, tropical circulation and convection, conditions of ocean are described with figures and tables.

> Southern Hemisphere

Asian Monsoon Monitoring last updated : 01 Nov 2008

5-day and monthly mean features of associated circulation and convection.

> Explanation of data and figures

Latitude-Longitude

Stream function, Wind & OLR	> 5-day	> monthly
Wave activity flux, Stream function & OLR	> 5-day	> monthly
Water vapour flux and its horizontal divergence	> 5-day	> monthly

Latitude-Time Cross Section

OLR	> 5-day
500 hPa Height and Normal	> 5-day
500 hPa Height anomaly and Normal	> 5-day

Time-Longitude Cross Section

Velocity Potential, OLR and Zonal Wind	> 5-day
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Time Series

Area-averaged OLR	> 5-day
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Links

- > WMO DDB (Various Climate-related Products and Data)
- > Monthly Climate Statistics for Japan
- > Summary of M...

Asian Monsoon Monitoring last updated : 01 Nov 2008

5-day and monthly mean features of associated circulation and convection.

> Explanation of data and figures

Latitude-Longitude

Stream function, Wind & OLR	> 5-day	> monthly
Wave activity flux, Stream function & OLR	> 5-day	> monthly
Water vapour flux and its horizontal divergence	> 5-day	> monthly

Latitude-Time Cross Section

OLR	> 5-day
500 hPa Height and Normal	> 5-day

<http://ds.data.jma.go.jp/tcc/tcc/index.html>



4. Statistical Relationships

4. Statistical Relationships

Climate System Monitoring / TCC - Microsoft Internet Explorer

ファイル(F) 編集(E) 表示(V) お気に入り(A) ツール(T) ヘルプ(H) 戻る 進む 印刷 検索 Google G 設定

アドレス http://ds.data.jma.go.jp/tcc/tcc/products/clisys/index.html

気象庁 Japan Meteorological Agency

Welcome to Tokyo Climate Center

TCC home About TCC Site Map Contact us

Home Climate in the World Climate System Monitoring El Niño NWP Model Global Climate in Training News

HOME > Climate System Monitoring

Climate System Monitoring

JMA monitors the present state of the global atmosphere and ocean, snow/ice coverage based on numerical objective analysis, and present climate including extreme events and long-term trends. Noting that homogeneous and consistent data is not available in cooperation with the Central Research Institute of Meteorology and Hydrology, analysis data for the period 1979-2004 was finalized. The same data assimilation system used in JRA project was used.

The normal was replaced by a new one based on Volume No.13 published in January 2007.
>> [Outlines of the New Atmospheric Circulation](#)

Main Products

Report on Climate System

Monthly features of extratropical circulation, tropical circulation and convection, conditions of ocean are described with figures and tables.

- Monthly Highlights on Climate System

Statistical Relationships

Atmospheric circulations regressed on tropical monitoring indices.

- Explanation of data and figures
- [NINO Indices](#)
- High-Cloud Amount Indices

- WMO DDB (Various Climate-related Products and Data)
- Monthly Climate Statistics for Japan
- Satellite Imagery of MTSAT-1R
- Tropical Cyclone Advisory : Tokyo Typhoon Center

page top

Tokyo Climate Center, Climate Prediction Division, 1-3-4 Otemachi, Chiyoda-ku, Tokyo, Japan.
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<http://ds.data.jma.go.jp/tcc/tcc/index.html>



Introduction of CPD's Climate Diagnostics Meeting

1. Outline of CPD's Climate Diagnostics Meeting

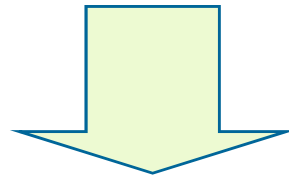
When? Around 8th every month

Who? Members of CPD/JMA

Members of Extreme Climate Events Diagnostics Group

Report and discuss about

- **Climate in Japan**
- **World Climate**
- **Oceanographic conditions**
- **Tropics**
- **Extra-tropics**



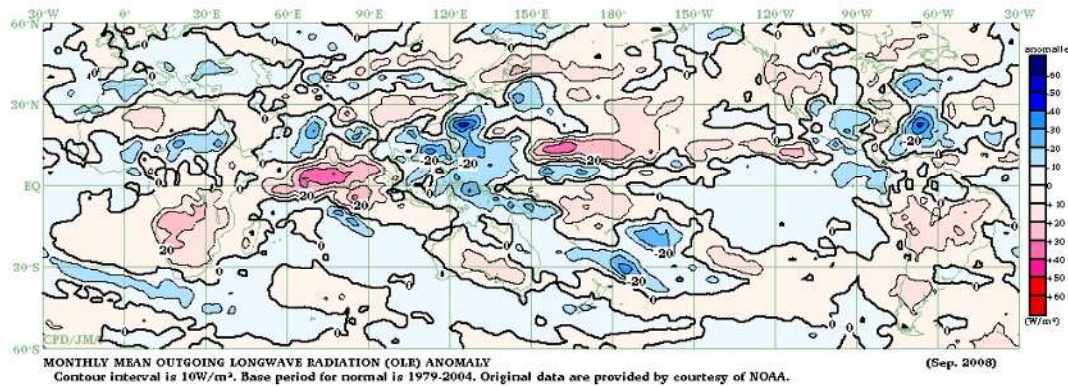
**Update Monthly highlights on Climate System on TCC Web Site
at around the middle of every month !**



2. Report on the tropical convection and large scale circulation in September

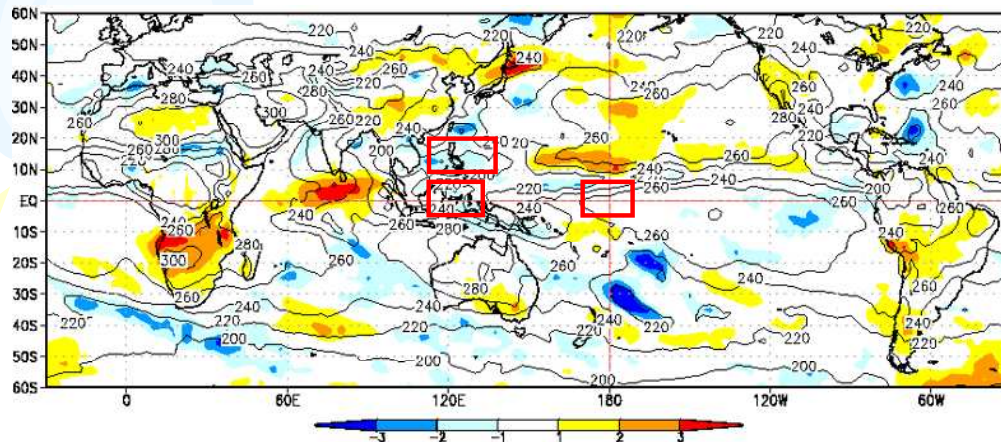
Climate Prediction Division, JMA

Outgoing Longwave Radiation



OLR anomaly

Convective activities were enhanced around Philippines and over eastern Maritime Continent, and suppressed over Indian Ocean. Enhanced convections were also observed over western Atlantic, Gulf of Mexico and eastern Pacific. Suppressed ones were observed over 10°N-20°N zone in Pacific.



OLR (contours) and normalized OLR anomaly (shadings)

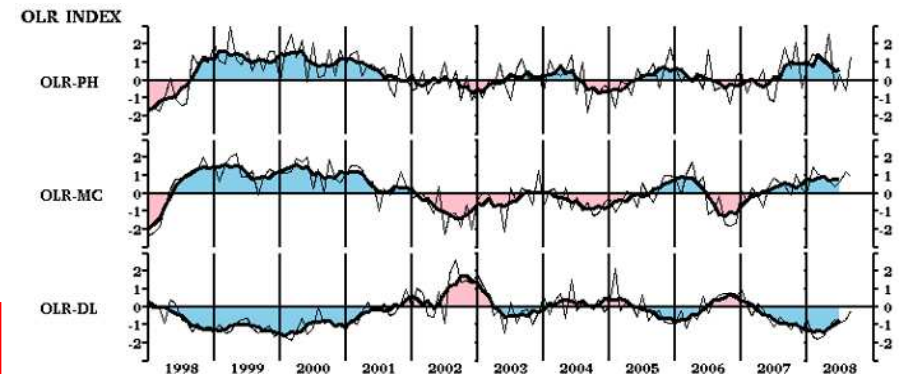
OLR-PH: +1.2 (-0.6)
OLR-MC: +0.8 (+1.2)
OLR-DL: -0.3 (-0.7)

SAMOI_A: +0.7 (-1.0)
SAMOI_N: +0.8 (+0.5)
SAMOI_W: -1.7 (+0.2)

Tropical disturbances

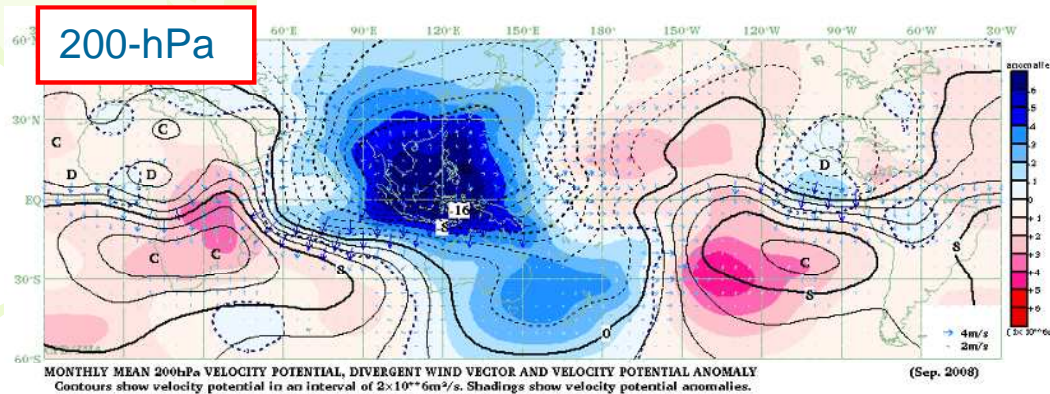
Western Pacific: Typhoon 13, 14, 15th

Atlantic: Hurricane "IKE", "KYLE"

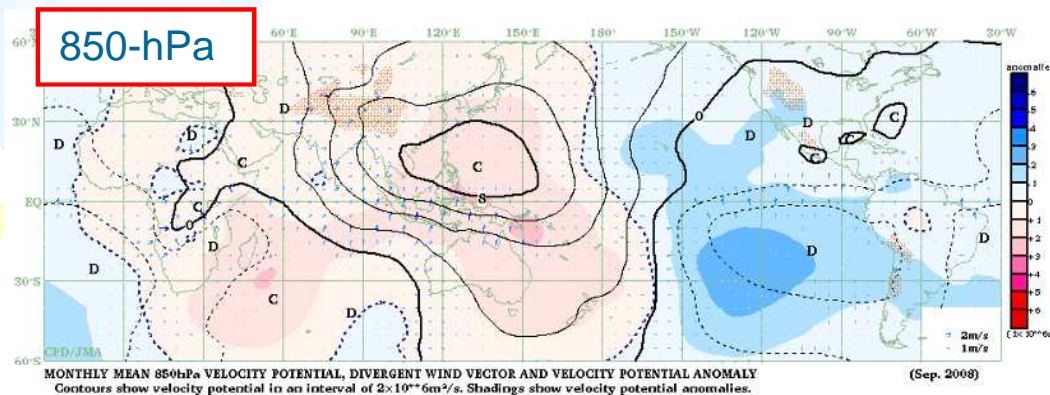
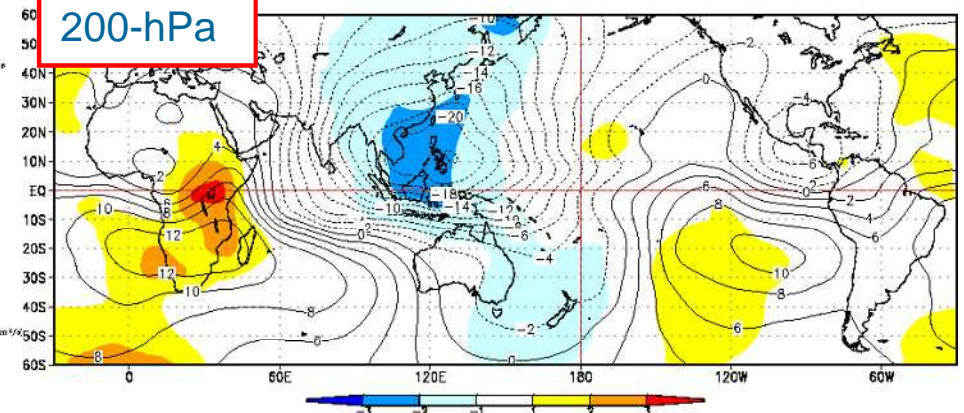


Time series of OLR index (1998-)

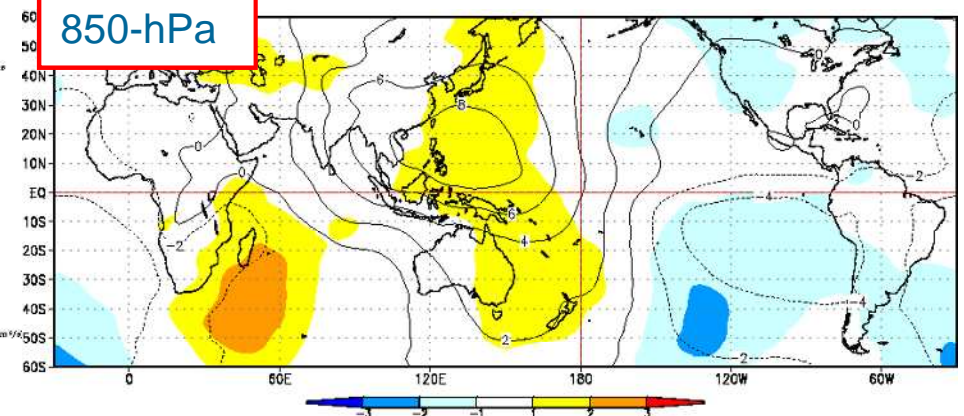
Velocity Potential



200-hPa velocity potential (contours) and velocity potential anomaly (shadings)

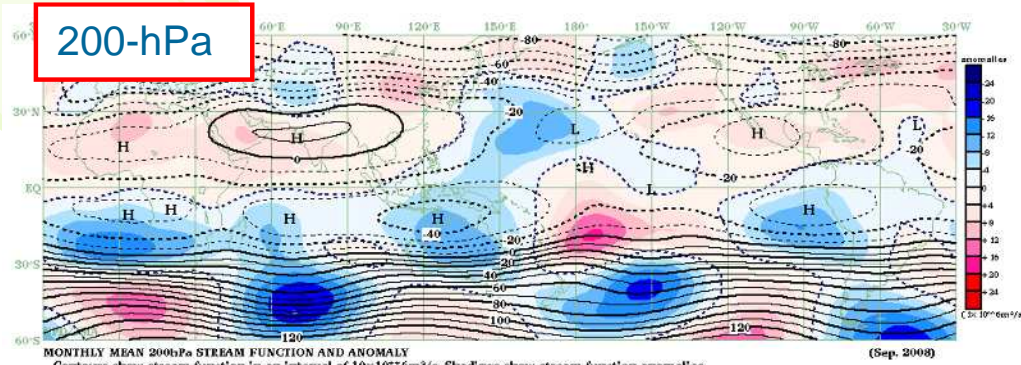


850-hPa velocity potential (contours) and velocity potential anomaly (shadings)

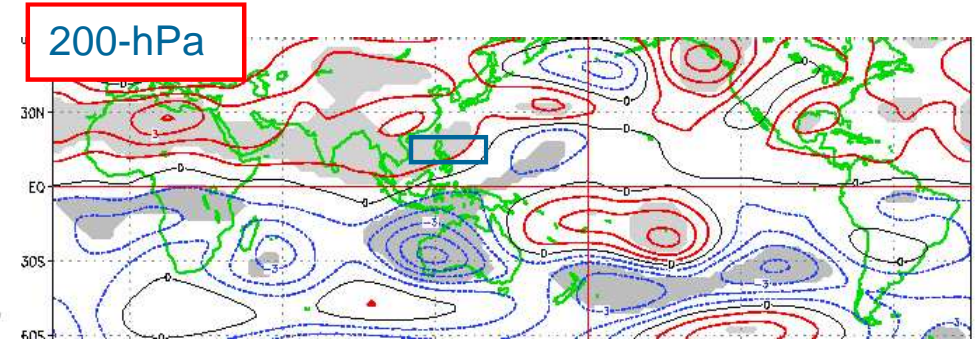


In the upper troposphere, center of large scale divergent region was located over Philippines and shifted westward from its normal position. Divergent region was also observed over eastern Pacific.

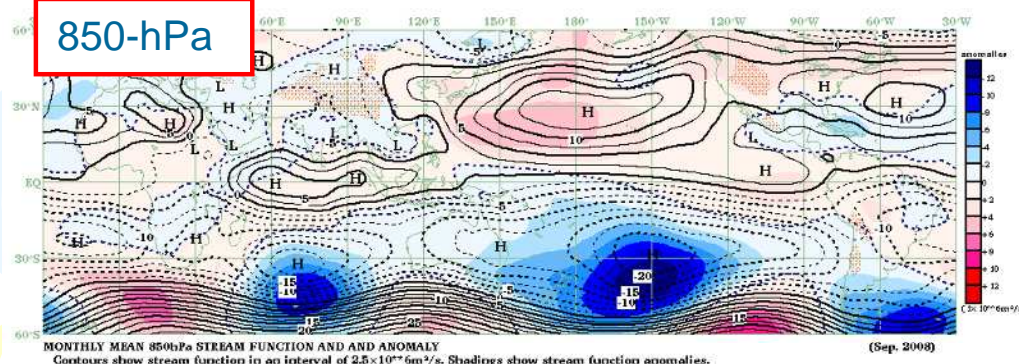
Stream Function



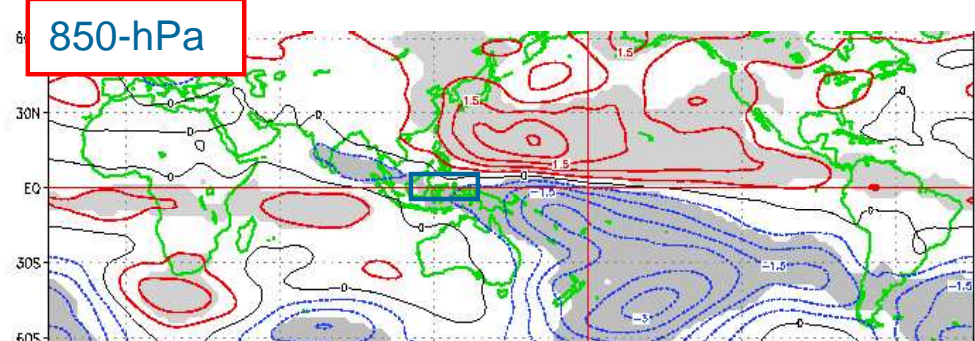
200-hPa stream function (contours) and stream function anomaly (shadings)



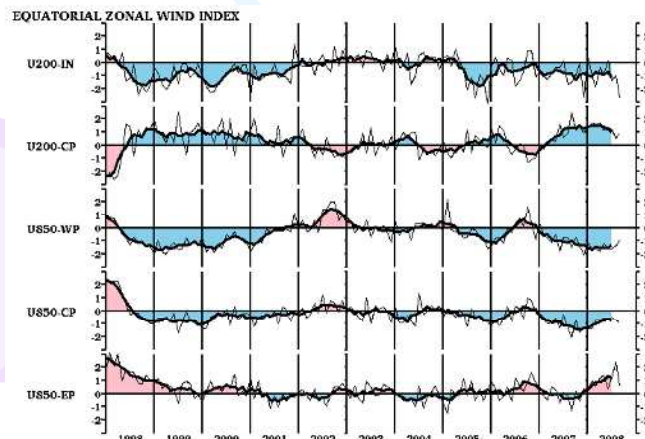
Regression coefficients between OLR-PH and Psi200 (Sep.)



850-hPa stream function (contours) and stream function anomaly (shadings)



Regression coefficients between OLR-MC and Psi850 (Sep.)



Time series of zonal wind index (1998-)

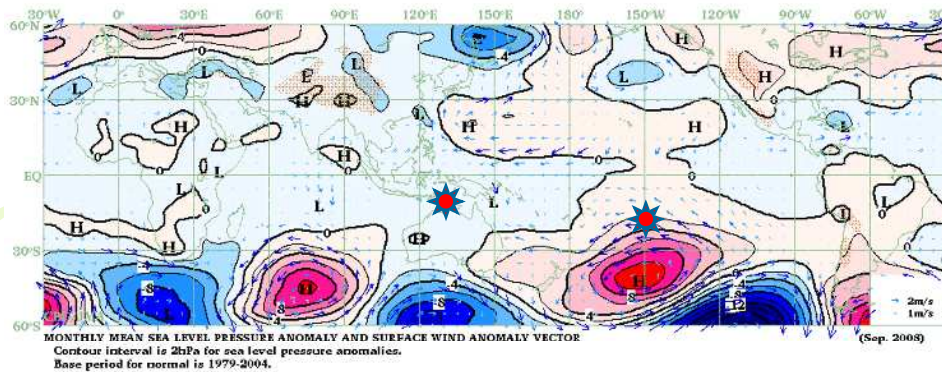
U200-IN: -2.7 (-1.0)
U200-CP: +0.9 (+0.5)

U850-WP: -0.9 (-1.4)
U850-CP: -0.9 (-0.7)
U850-EP: +0.6 (+2.4)

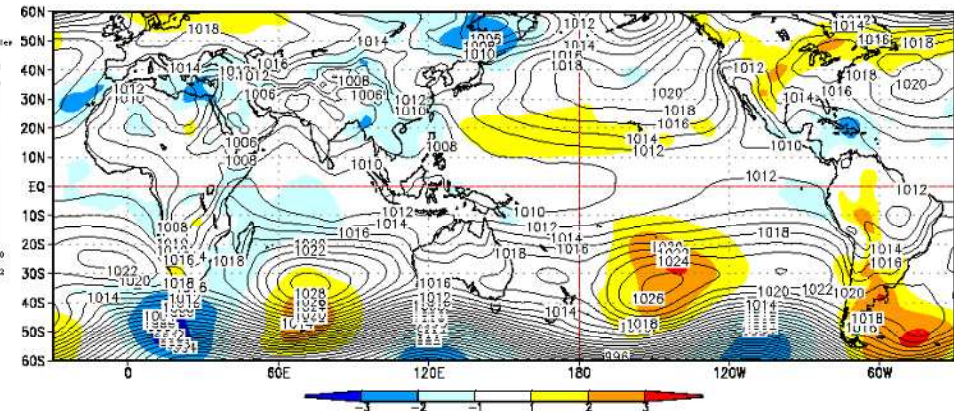
In the upper troposphere, remarkable anti-cyclonic circulation anomalies were observed in northern hemisphere side over Indian Ocean.

In the lower troposphere, Pacific subtropical high was stronger than its normal, especially remarkable over from the south from Japan to 150°W.

Sea Level Pressure and Southern Oscillation Index (SOI)

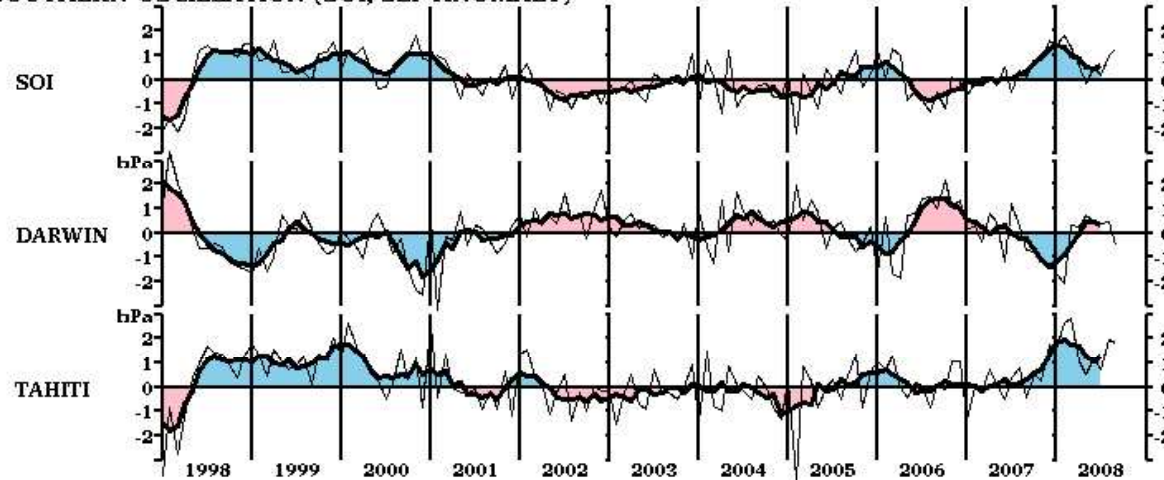


Sea level pressure anomalies (contours) and 10-m surface wind anomalies (vector)



Sea level pressure (contours) and normalized sea level pressure anomalies (shadings)

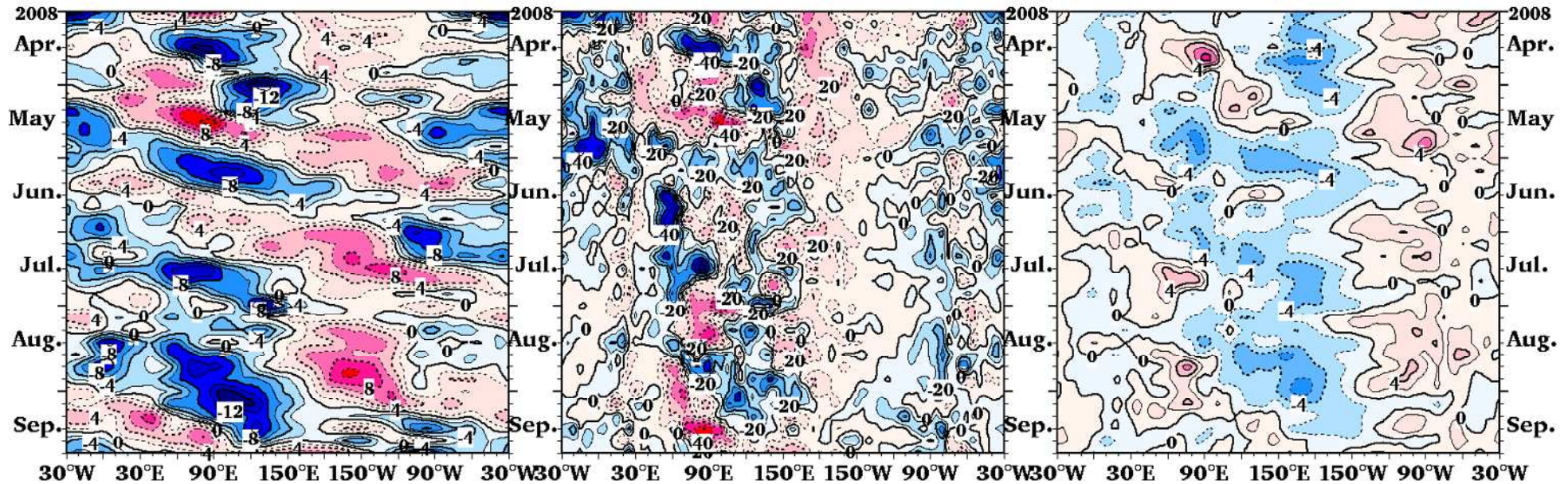
SOUTHERN OSCILLATION (SOI, SLP ANOMALY)



Time series of SOI, SLP anomaly (1998-)

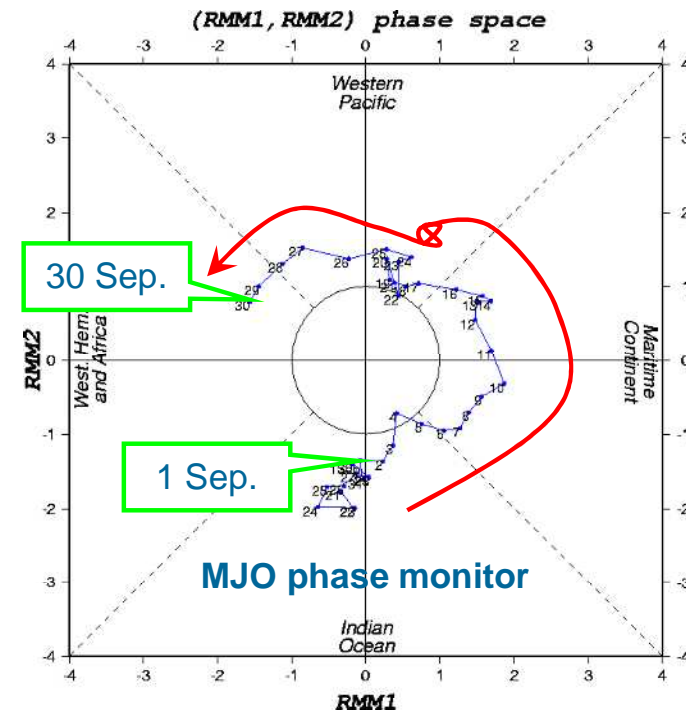
SOI: +1.2 (+1.1)
Darwin: -0.4 (+0.3) hPa
Tahiti: +1.8 (+2.0) hPa

Madden-Julian Oscillation (MJO)

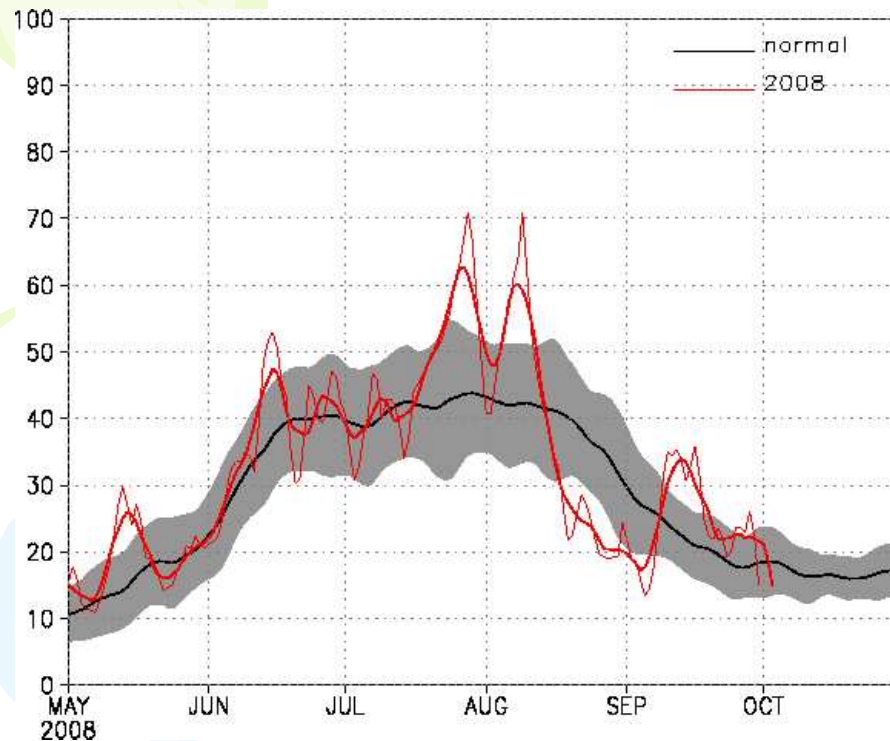


Hovmöller diagram of 200-hPa velocity potential anomalies (left), OLR anomalies (center) and 850-hPa zonal wind anomalies (right) (5°S-5°N averaged)

In early and mid-September, active phase of MJO clearly propagated eastward from Indian Ocean to Maritime Continent and 200-hPa velocity potential anomalies indicated zonal wave number 1 pattern. The eastward propagation temporarily became obscure over western Pacific.



Asian Summer Monsoon



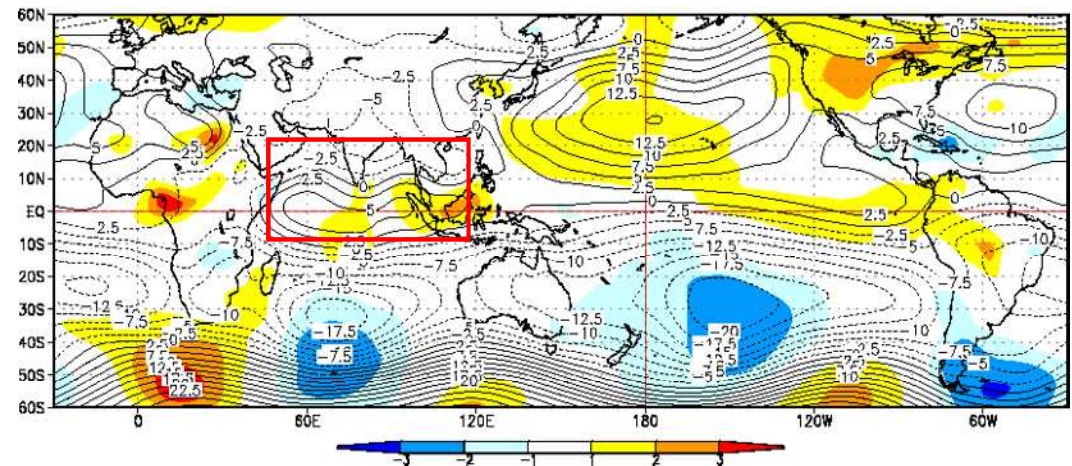
Kinetic energy calculated by 850-hPa rotational wind (unit: m^2/s^2)

The region for calculation is 10°S - 20°N , 50°E - 120°E . Thin red lines show daily value and thick red line shows 7-day running mean value. Shading indicates the standard deviation ± 1.0 .

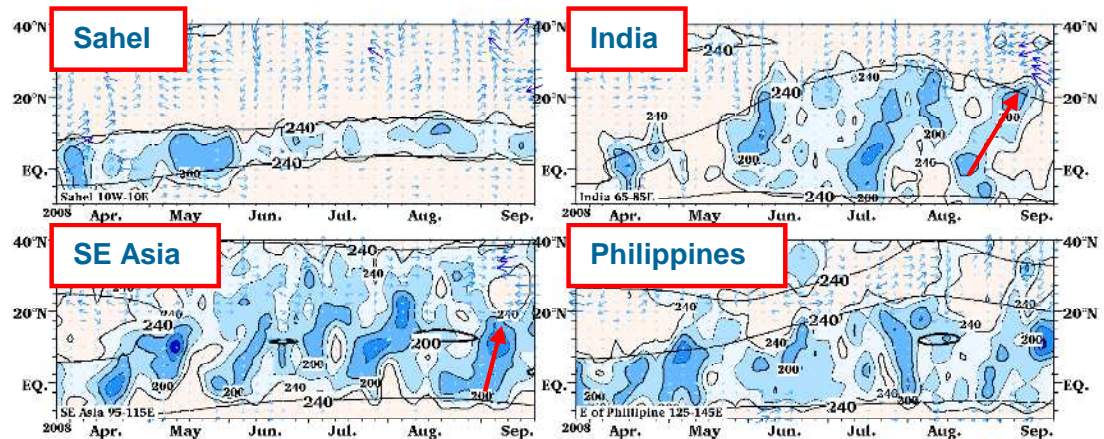
Original by Masashi Ujiie (2006)

From the second half of August to early September, Asian monsoon circulation in the lower troposphere was weaker than normal, and supply of water vapor to the Asian monsoon region was less than normal. Convective activities were suppressed from Bay of Bengal to South China Sea and east of Philippines.

In mid-September, the monsoon circulation was strengthened associated with the passage of active phase of the MJO. Enhanced convective area moved northward in the Asian monsoon region, and convective activities were suppressed over Indian Ocean.



The region for calculation of Kinetic energy (red line rectangular area)

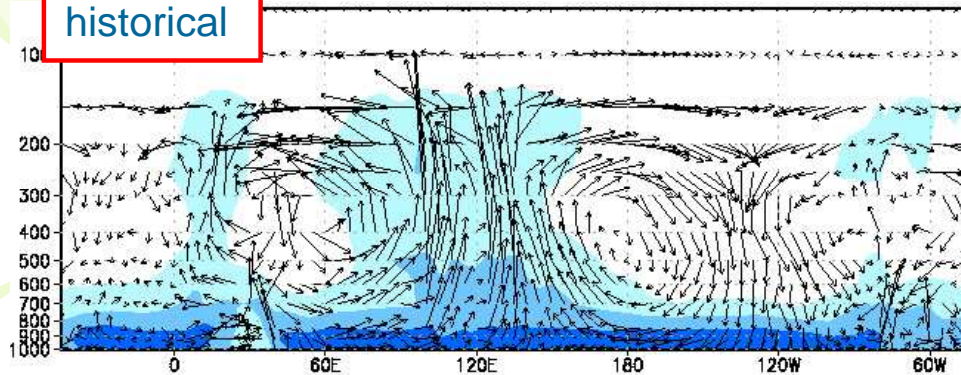


Latitude-time cross sections of OLR (shadings) and normal OLR (contours)

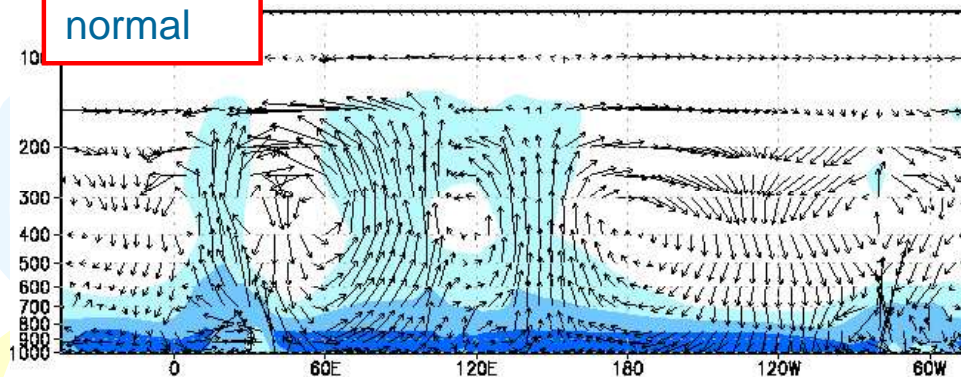
Walker Circulation (5°S-5°N mean)

JCDAS

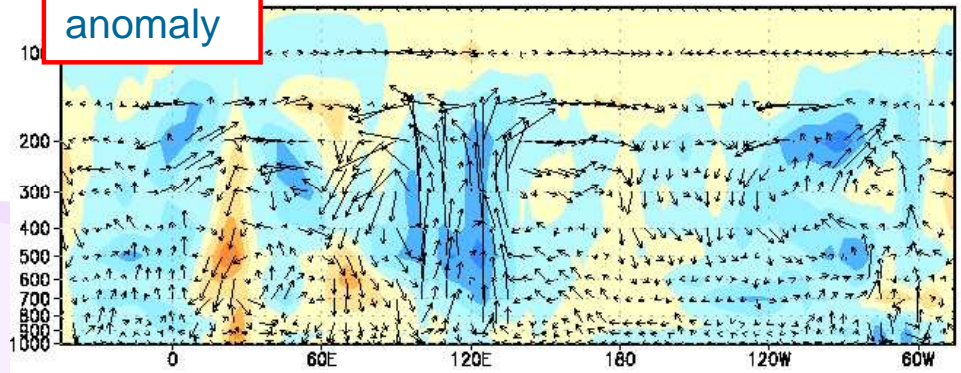
historical



normal

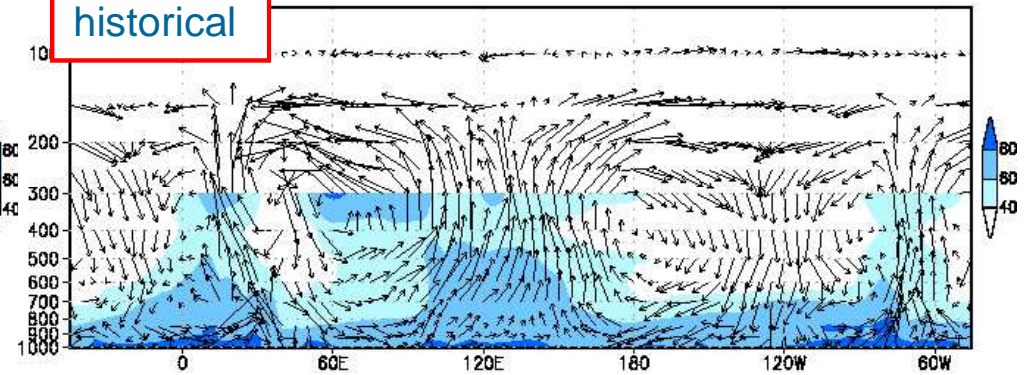


anomaly

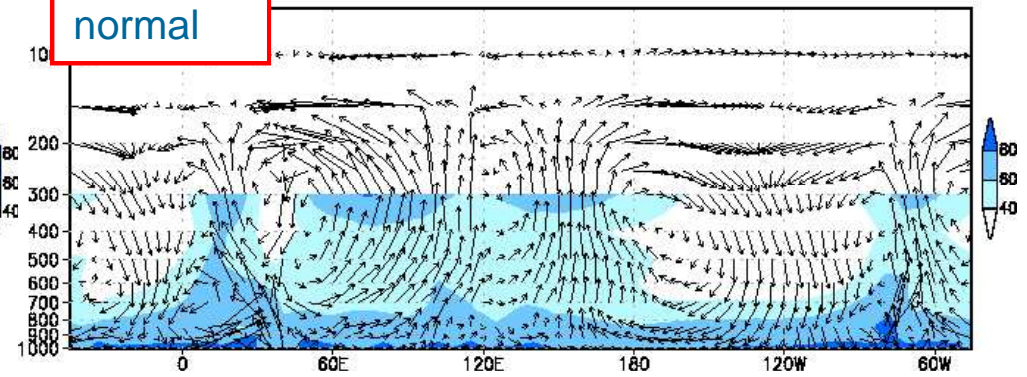


CDAS1

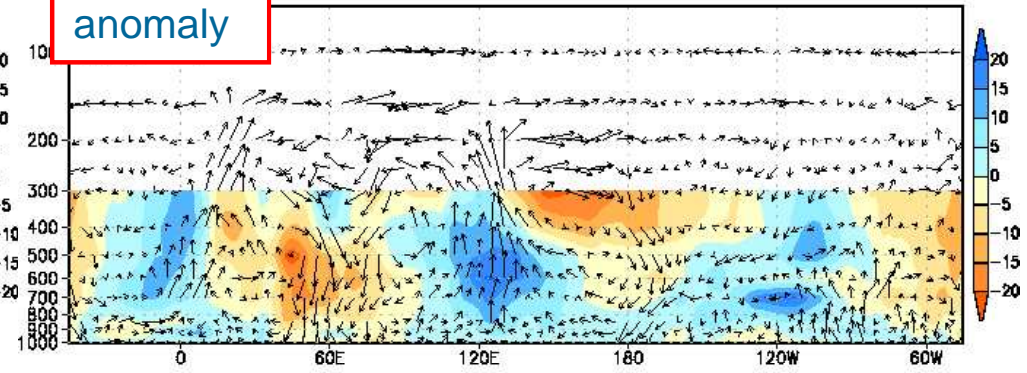
historical



normal



anomaly



\vec{u}

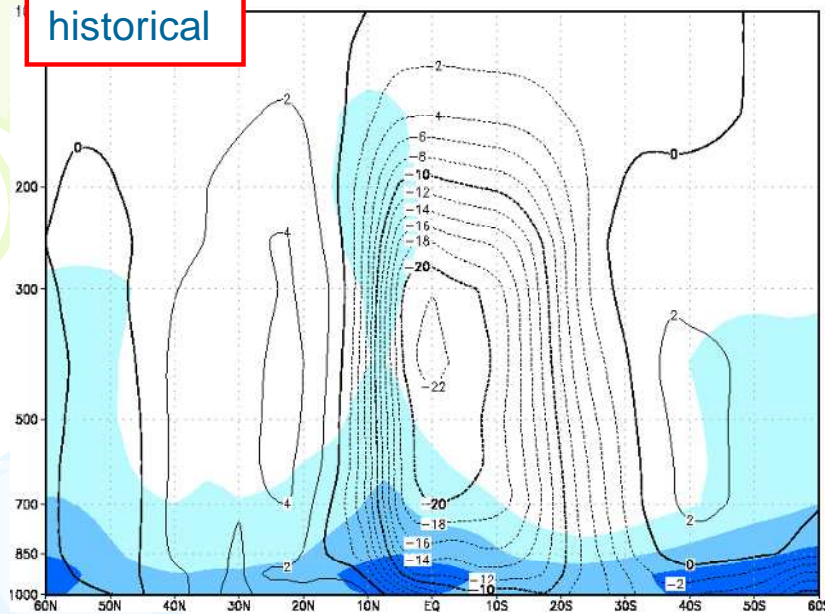
\vec{u}

Relative humidity (shadings), divergent zonal wind (m/s) and vertical velocity ($\times 50 \text{ Pa/s}$) (vectors)

Hadley Circulation

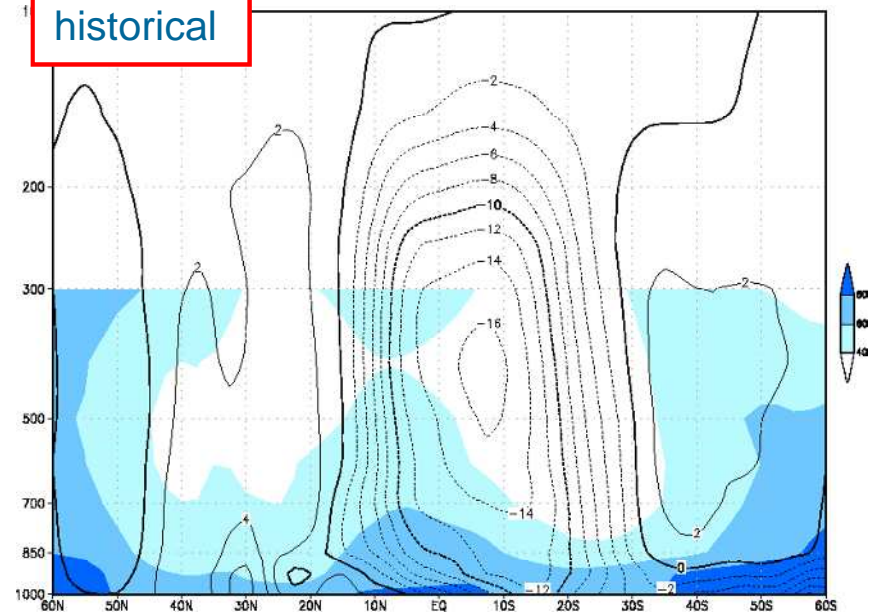
JCDAS

historical

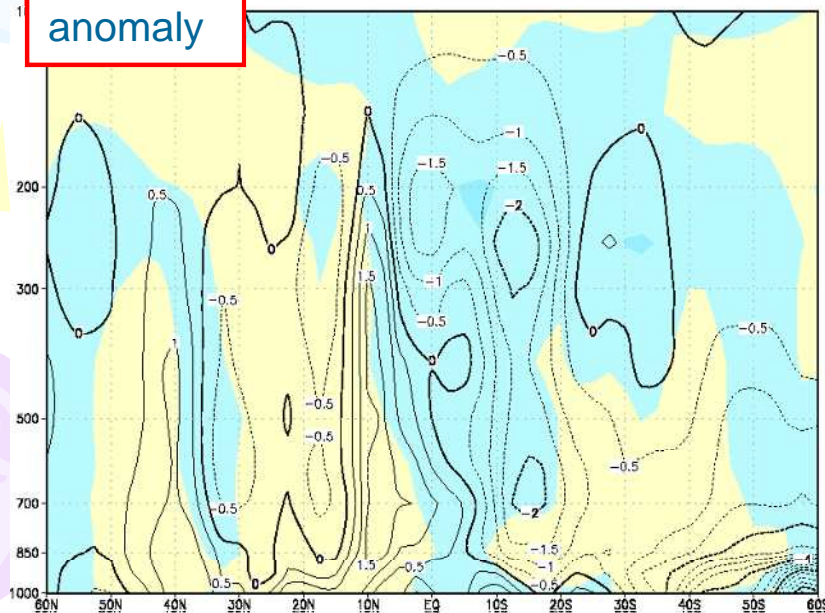


CDAS1

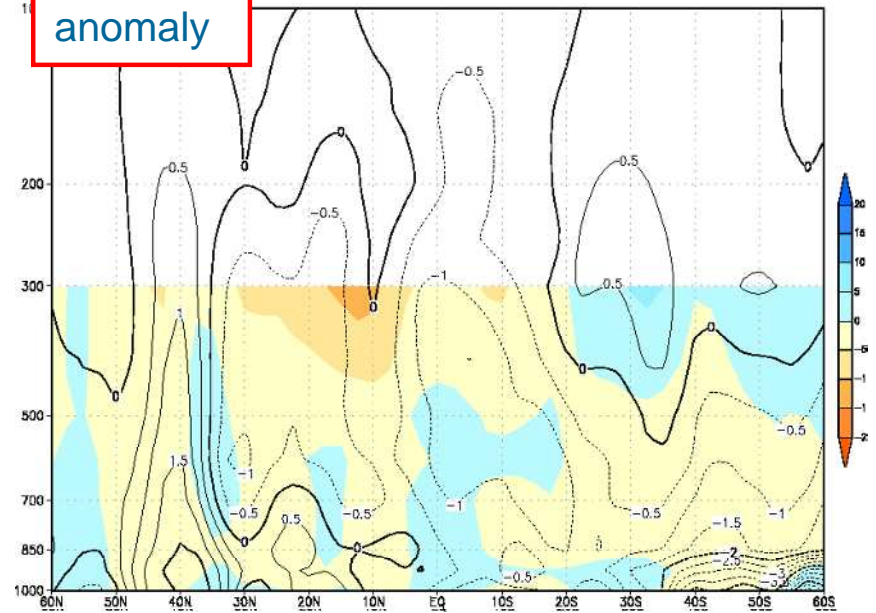
historical



anomaly



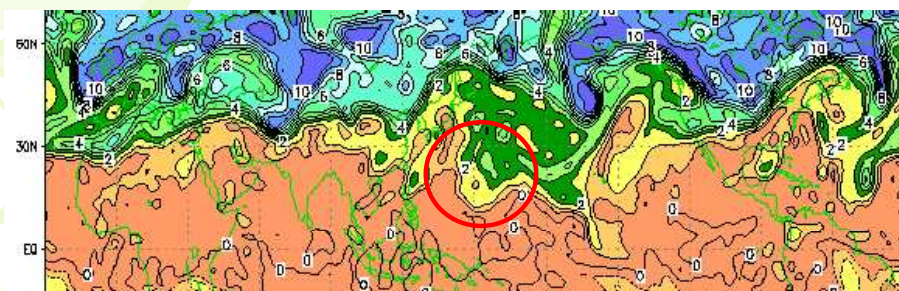
anomaly



TEM stream function ($\times 10^{10}$ kg/s, contours) and relative humidity (shadings)

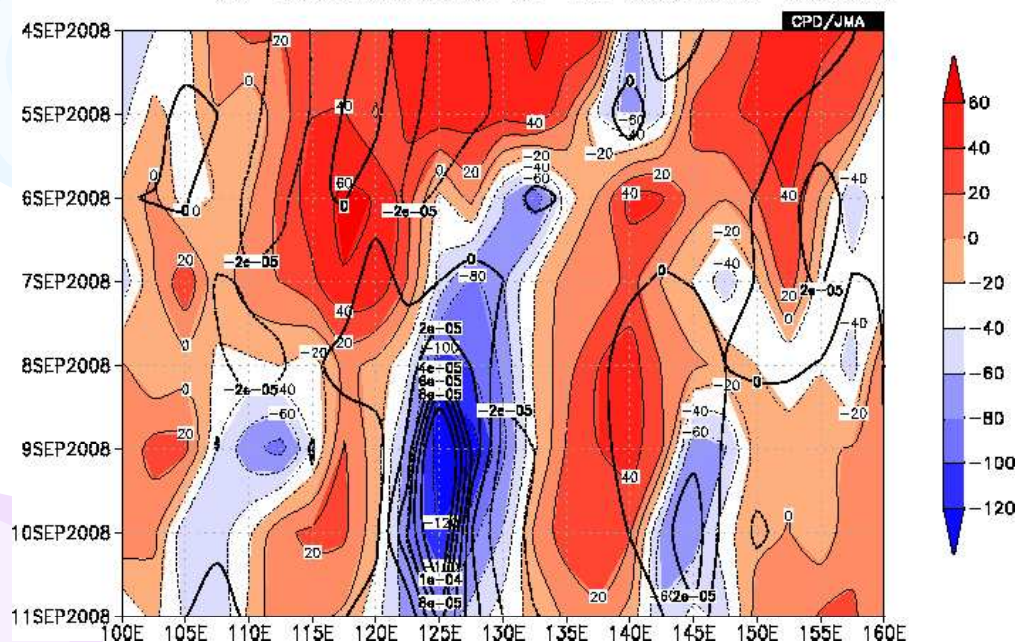
Tropical Disturbances

Typhoon 13th “SINLAKU” (8-20 Sep.)



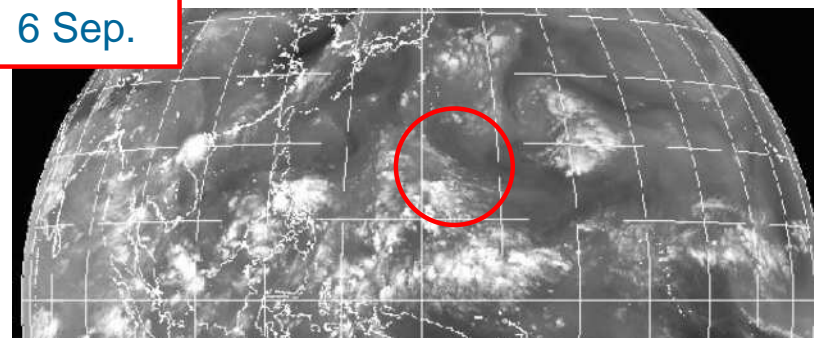
Q-map at 350 K (00 UTC 6 Sep.)

DATA1 SAT_olr ANOM lat = 17.5:20 lon = 100:160 level = 1:1
time = 2008090400:2008091100 ave = 1DAY
DATA2 JRA-JCDAS vor23 ANOM lat = 17.5:20 lon = 100:160 level = 3:3
time = 2008090400:2008091100 ave = 1DAY analysis method = DATA1_DATA2

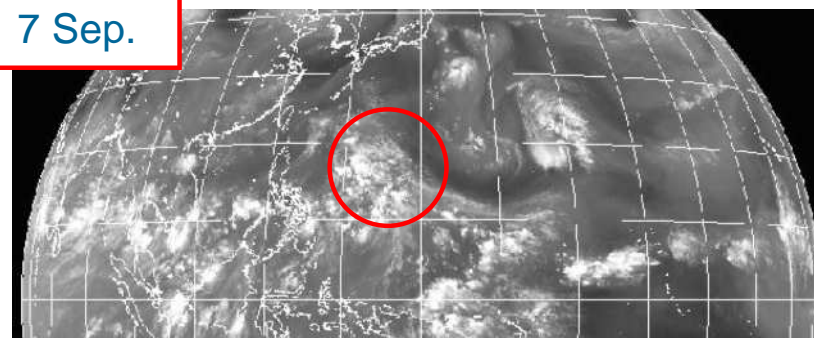


Time-longitude cross section of 850-hPa relative vorticity anomaly (contours) and OLR anomaly (shadings) (17.5°N-20°N mean)

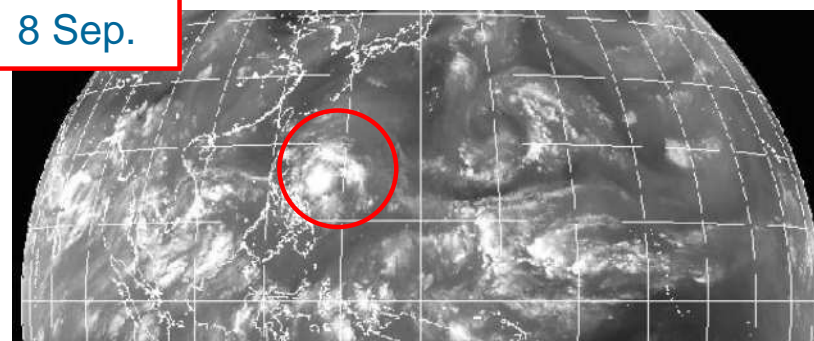
6 Sep.



7 Sep.



8 Sep.

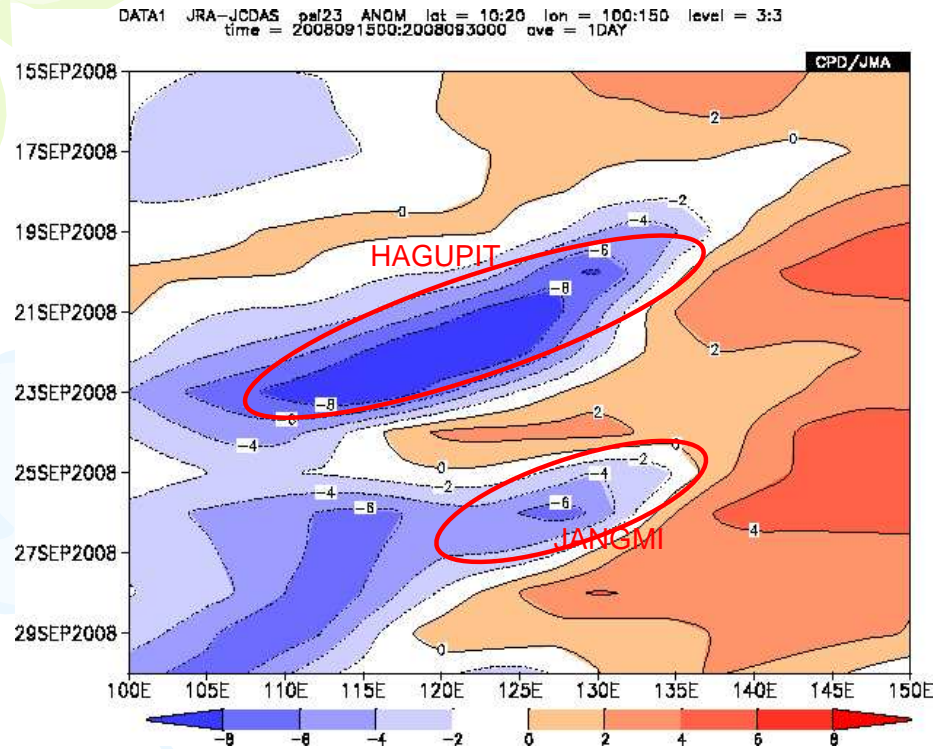


Satellite image of water vapor at 00 UTC

On 6 September, high potential vorticity moved southward from mid-latitude zone in the upper troposphere and activated convective activity there. The active convection propagated westward and developed into Typhoon 13th “SINLAKU”.

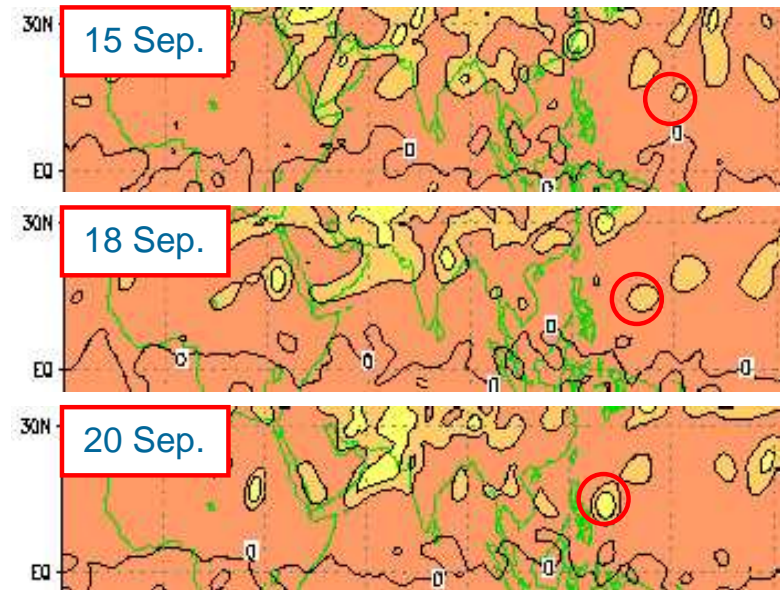
Tropical Disturbances

Typhoon 14th “HAGUPIT” (18-24 Sep.)

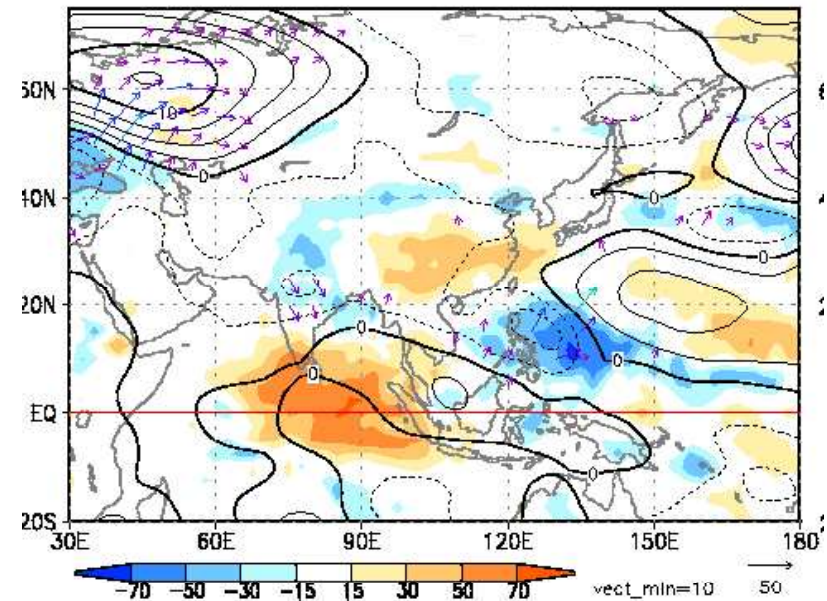


Time-longitude cross section of 850-hPa stream function anomaly (10°N-20°N mean)

Vorticity, which moved westward in 15°N-20°N zone, developed into typhoon 14th “HAGUPIT”. Cyclonic circulation anomaly associated with the typhoon emanated quasi-stationary Rossby wave packets to the northeast and strengthened anti-cyclonic anomaly over the south of Japan.



Q-map at 330 K (00UTC)



850-hPa stream function anomaly (contours), OLR anomaly (shadings) and wave activity flux (vectors) (18-22 Sep.)



Summary

In the first half of September, active phase of MJO propagated from Indian Ocean to Maritime Continent. Asian monsoon activity was activated by the passage of active phase of MJO. Active convection area moved northward over Asian monsoon region and convective activities were suppressed over equatorial Indian Ocean.

In the equatorial lower troposphere, remarkable eastern wind anomalies were observed from western to central Pacific.

In the second half of September, the Active phase of MJO propagated from Maritime Continent to western Pacific, though its eastward propagation became obscure temporarily.



3. Report on the extra-tropical atmospheric circulation in September 2008

Climate Prediction Division, JMA

(PSI300 & WAE200)

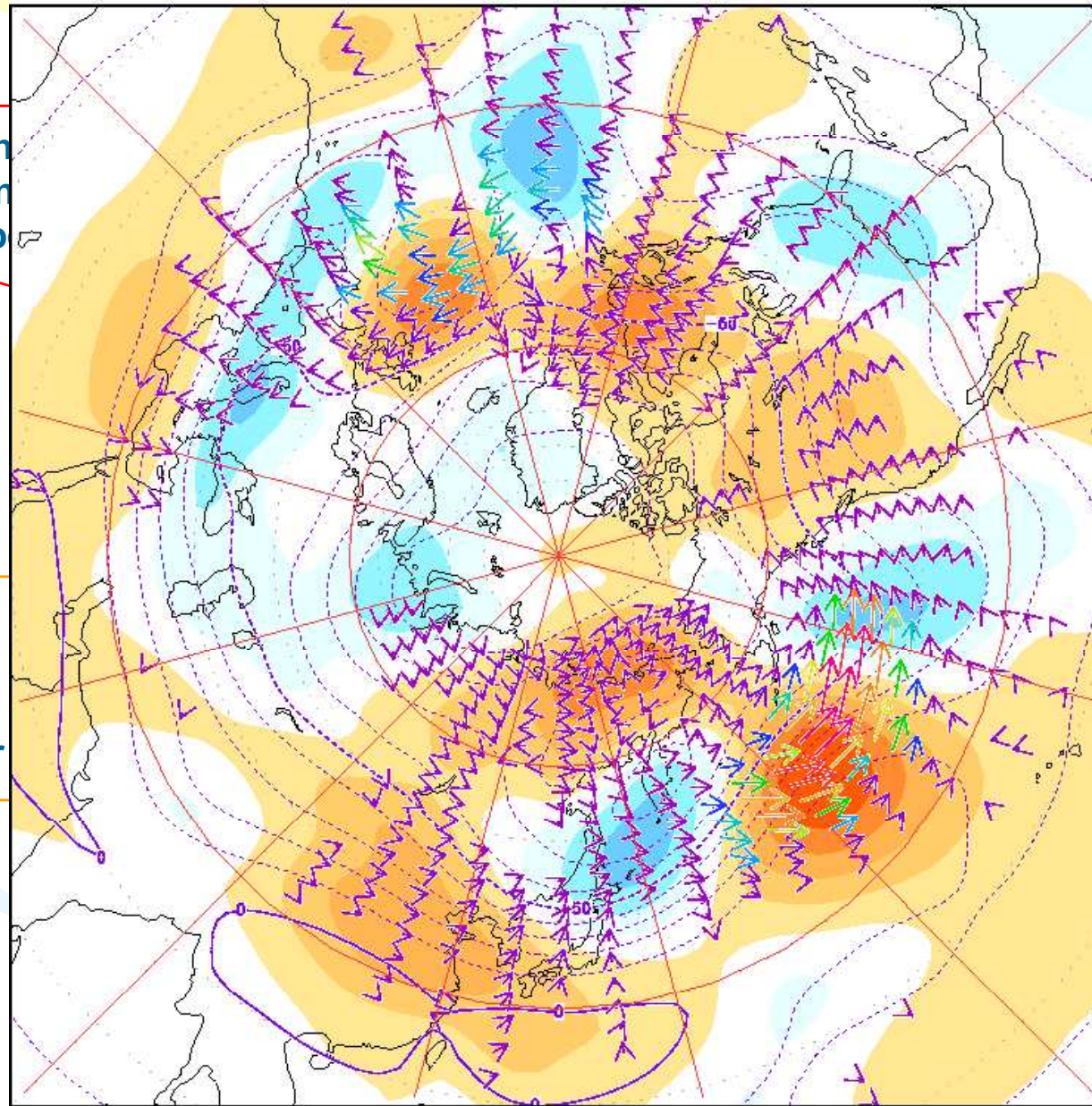
Trough deepened in
25SEP2008–10OCT2008

Blocking high
developed in
September

developed in late
September

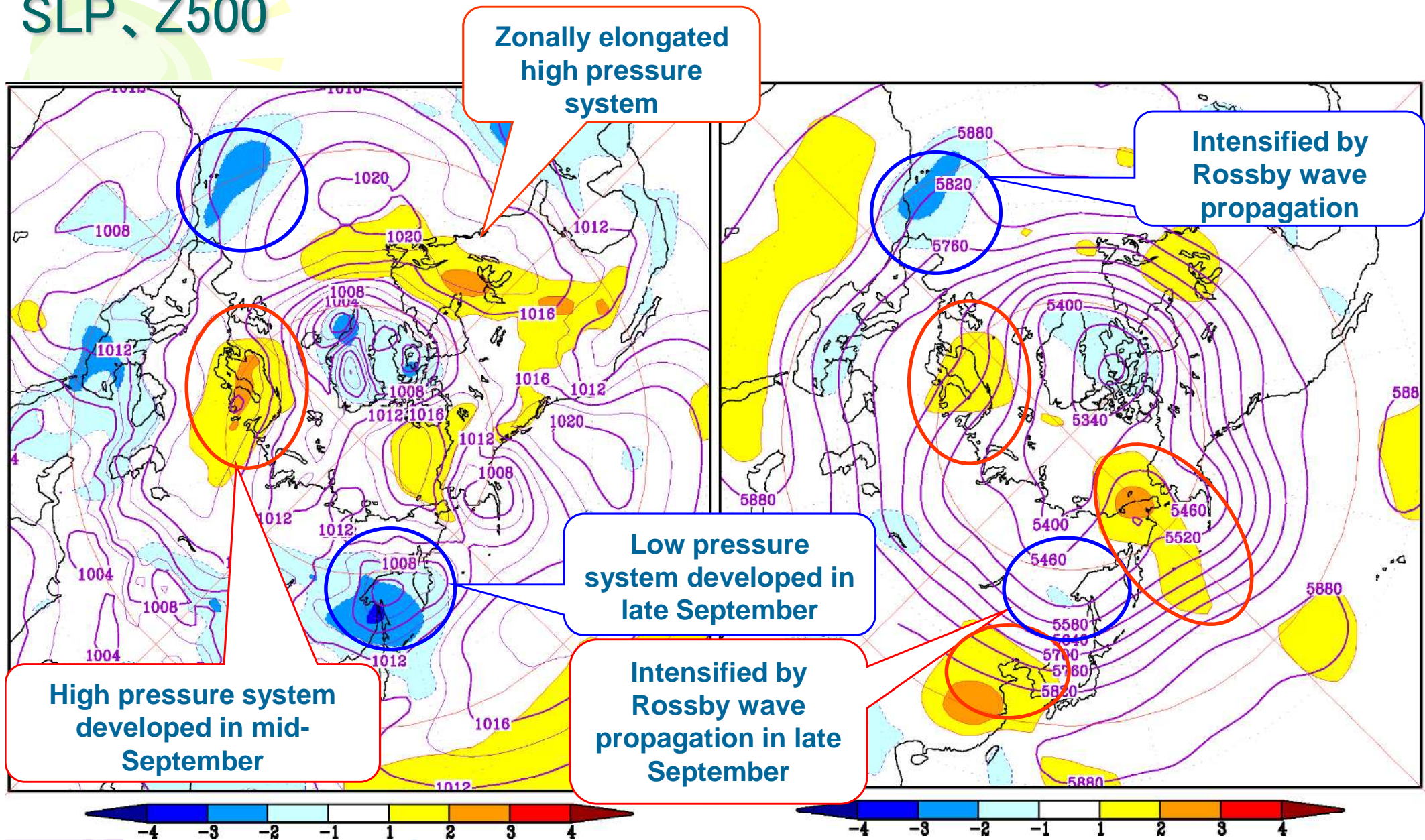
Rossby wave
propagation
intensified Ridge
in late September

Rossby wave
propagation from early
to mid-September



Monthly mean 300-hPa stream function, its anomalies and wave activity flux in Sep. 2008.
Shadings show 300-hPa stream function anomalies. Contours show 300-hPa stream function at an interval of $10 \times 10^6 \text{ (m}^2/\text{s}^2)$.

SLP, Z500



Monthly mean sea level pressure and its anomalies in Sep. 2008.

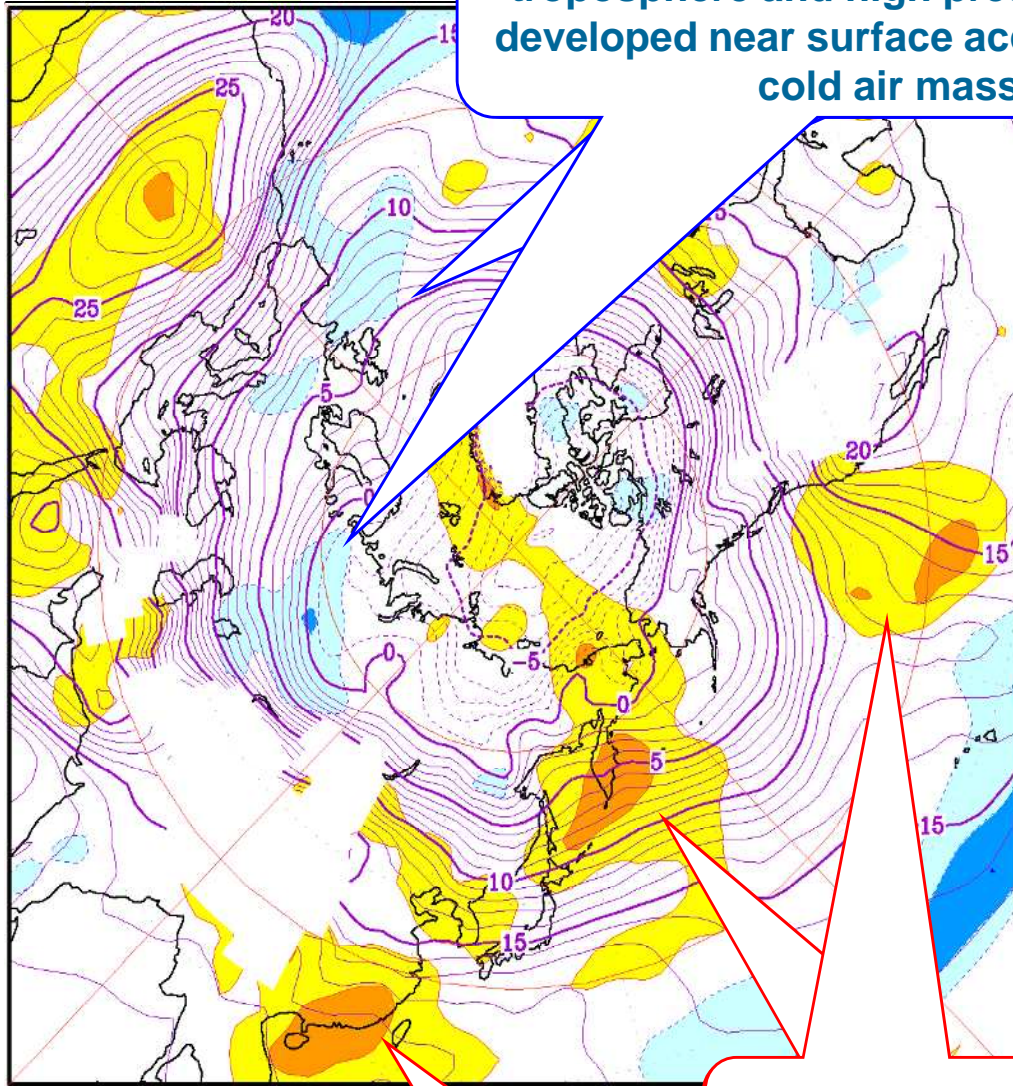
Shadings show sea level pressure anomalies. Contours show sea level pressure at an interval of 4-hPa.

Monthly mean 500-hPa height and its anomalies in Sep. 2008.

Shadings show 500-hPa height anomalies. Contours show 500hPa height at an interval of 60-m.

1850, SLP

Trough developed in the upper troposphere and high pressure system developed near surface accompanied by cold air mass



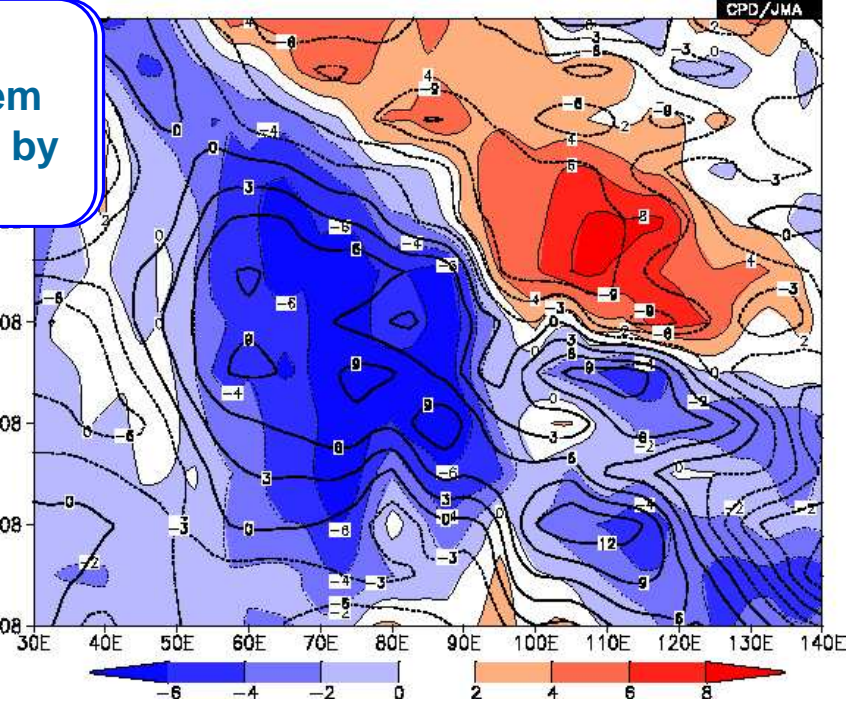
Monthly mean 850-hPa temperature anomalies in Sep. 2008

Shadings show 850-hPa temperature anomalies. Contour interval is 3-hPa.

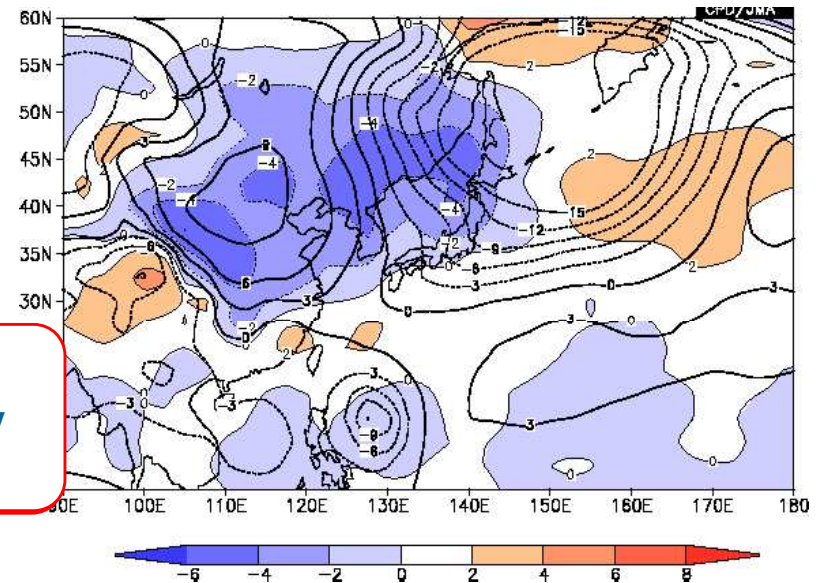
Warm temperature associated with Rossby wave propagations

Warm temperature associated with Rossby wave propagation in late September

21SEP2008
23SEP2008
25SEP2008
27SEP2008



Time-longitude cross section of sea level pressure anomaly (contours) and 2-m temperature anomaly (shadings) (along 45°N). Contour interval is 3-hPa.



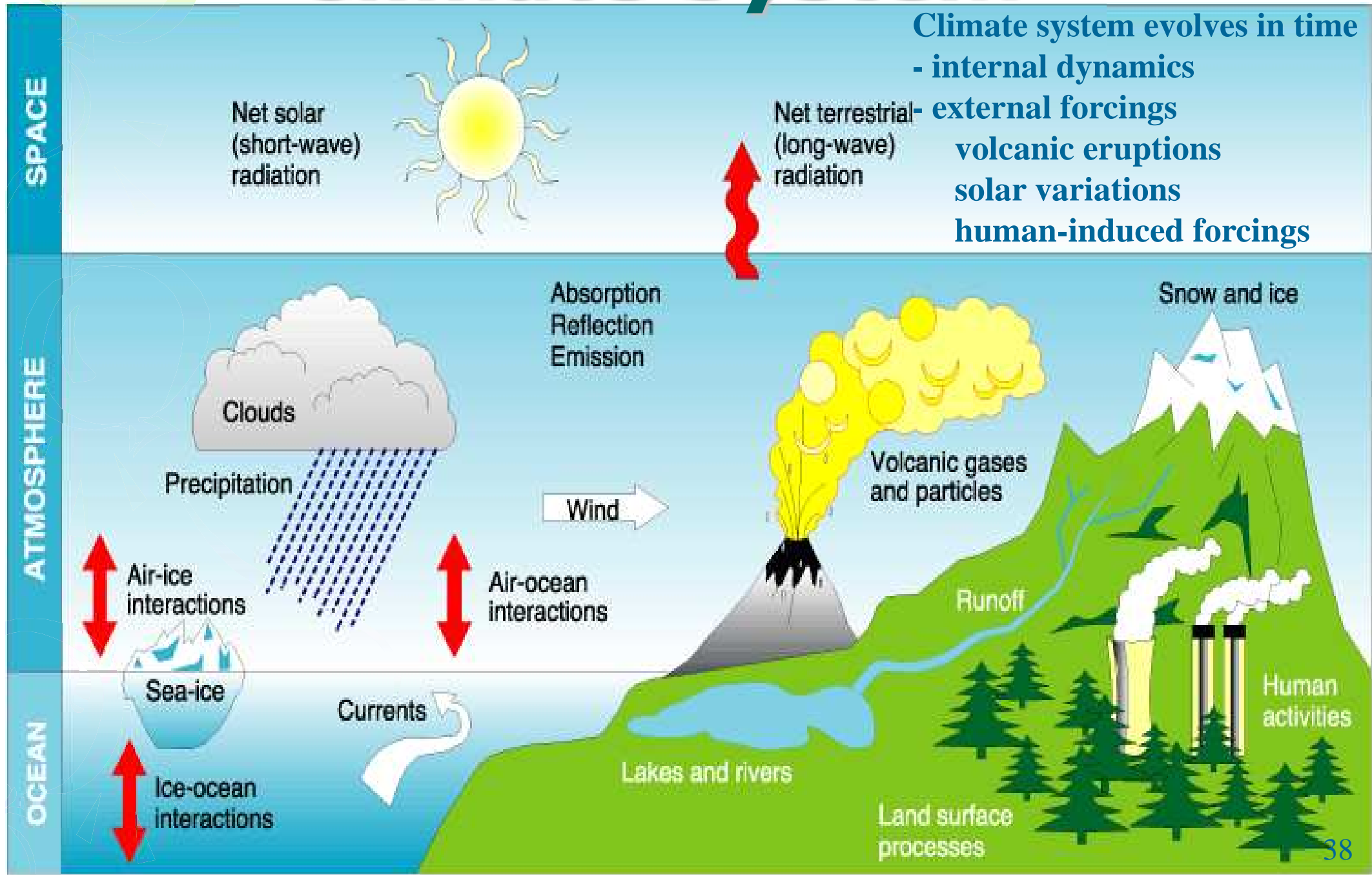
Sea level pressure anomaly (contours) and 2-m temperature anomaly (shadings) on 26 Sep. 2008. Contour interval is 3-hPa.



**Thank you for
your attention!**



Climate System



(solenoidal + irrotational component)
(divergence-free) (curl-free) .
Helmholtz's theorem

(Rotational wind)

$$u_\psi = -\frac{\partial \psi}{\partial y}, v_\psi = \frac{\partial \psi}{\partial x}$$

ψ : stream function

Rotation

$$rot \vec{v}_\psi = \frac{\partial v_\psi}{\partial x} - \frac{\partial u_\psi}{\partial y} = \frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} = \nabla^2 \psi$$

Divergence

$$div \vec{v}_\psi = \frac{\partial u_\psi}{\partial x} + \frac{\partial v_\psi}{\partial y} = -\frac{\partial^2 \psi}{\partial x \partial y} + \frac{\partial^2 \psi}{\partial y \partial x} = 0$$

- The larger gradient ψ is, the stronger rotational wind is.
- Rotational wind blows parallel to ψ
- The wind blows with seeing smaller ψ on the left side

(left side) ψ : smaller

u_{ψ_1} $-\frac{\partial \psi_1}{\partial y} : \text{larger}$
 u_{ψ_2} $-\frac{\partial \psi_2}{\partial y} : \text{smaller}$

(right side) ψ : larger

Divergence Wind

(Divergence wind)

$$u_{\chi} = \frac{\partial \chi}{\partial x}, v_{\chi} = \frac{\partial \chi}{\partial y}$$

χ : Velocity potential

Rotation

$$rot \vec{v}_{\chi} = -\frac{\partial v_{\chi}}{\partial x} + \frac{\partial u_{\chi}}{\partial y} = -\frac{\partial^2 \chi}{\partial x y} + \frac{\partial^2 \chi}{\partial y x} = 0$$

Divergence

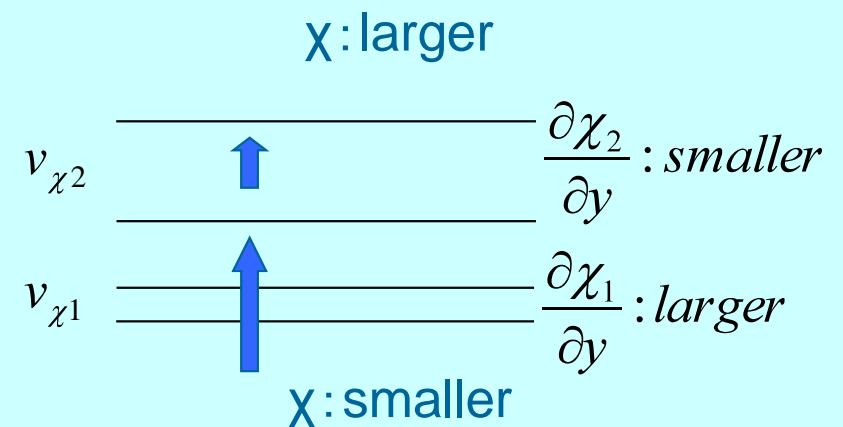
$$div \vec{v}_{\chi} = \frac{\partial u_{\chi}}{\partial x} + \frac{\partial v_{\chi}}{\partial y} = \frac{\partial^2 \chi}{\partial x^2} + \frac{\partial^2 \chi}{\partial y^2} = \nabla^2 \chi$$

- Divergence wind blows at right angle to χ .

- The larger gradient χ is, the stronger divergence wind is.

$$div \vec{v} = div(\vec{v}_{\chi} + \vec{v}_{\psi}) = div \vec{v}_{\chi} = \nabla^2 \chi$$

$$rot \vec{v} = rot(\vec{v}_{\psi} + \vec{v}_{\chi}) = rot \vec{v}_{\psi} = \nabla^2 \psi$$



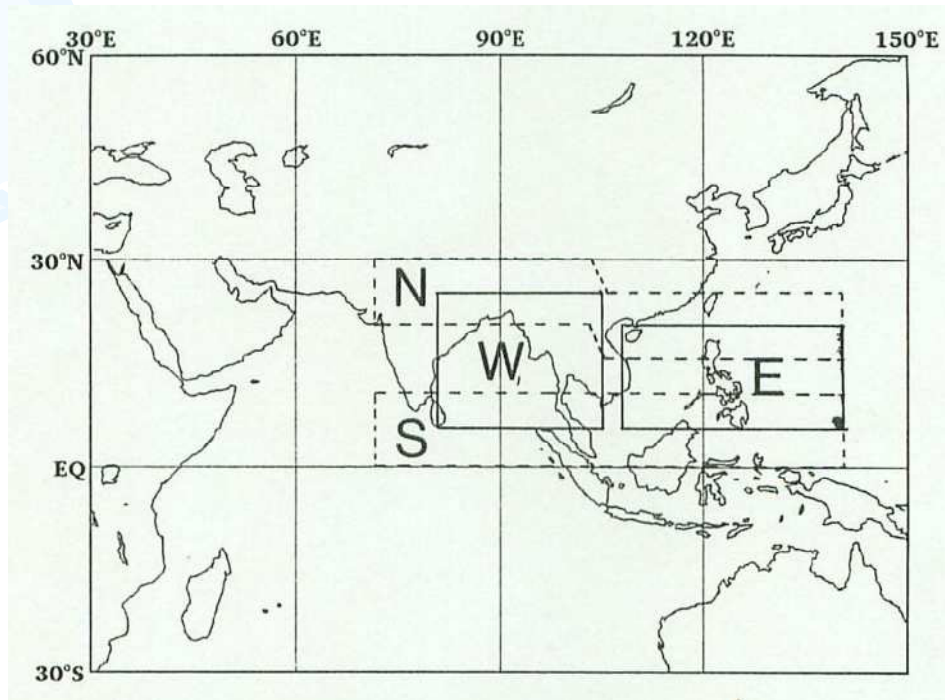
SAMOI : Summer Asian Monsoon OLR Indices

Indicator of convective activities with Asian Monsoon

$\text{SAMOI_A} = \text{normalized } ((-1) \times \text{OLR}(W+E)) \rightarrow \text{Activity}$

$\text{SAMOI_N} = \text{normalized } (\text{normalized OLR}(S) - \text{normalized OLR}(N)) \rightarrow \text{Northward shift}$

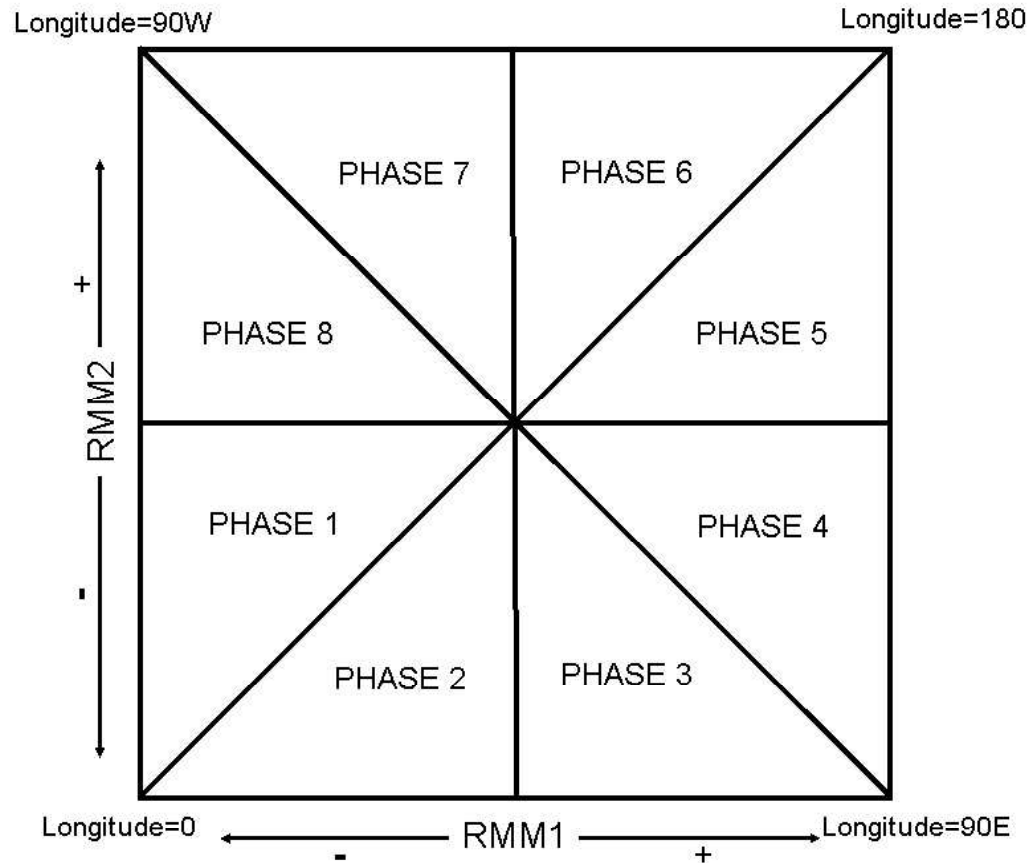
$\text{SAMOI_W} = \text{normalized } (\text{normalized OLR}(E) - \text{normalized OLR}(W)) \rightarrow \text{Westward shift}$



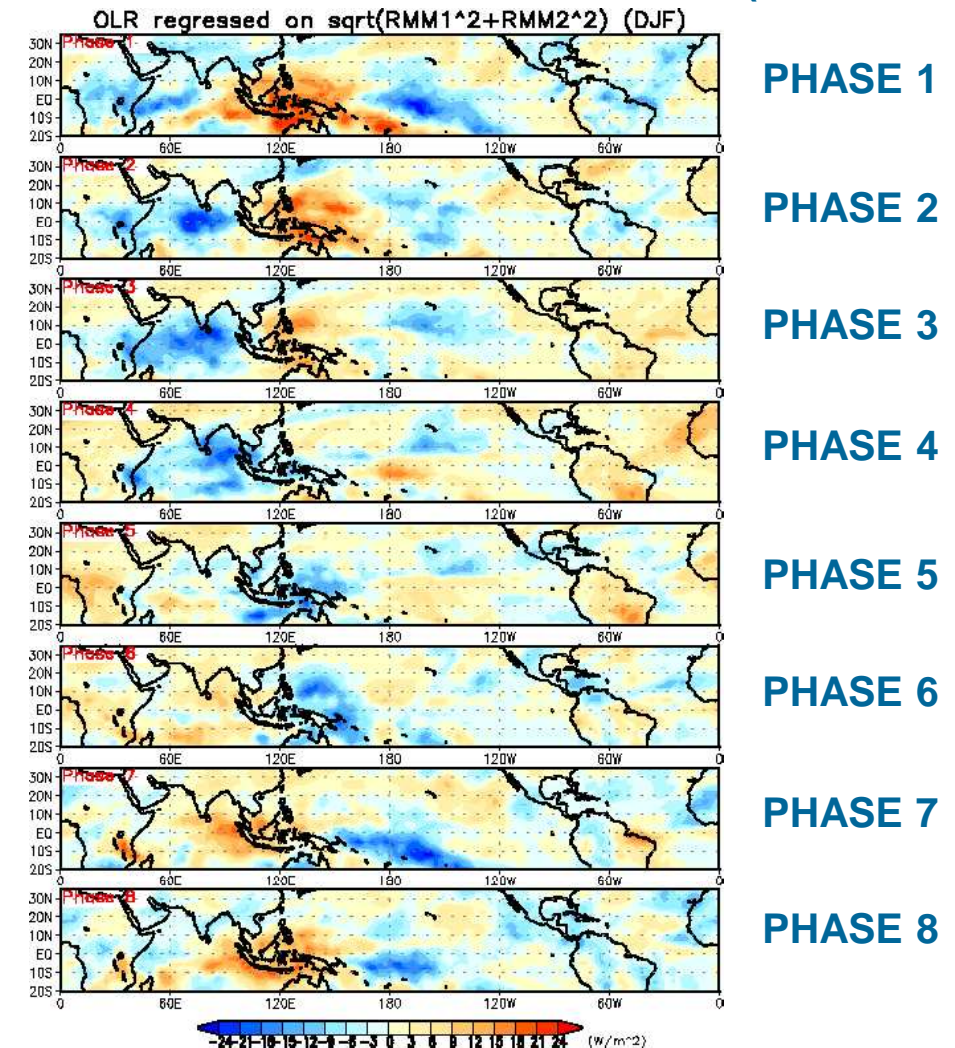
Region for calculation

SAMOI_A has a high correlation with summer northern Japan temperature.

About MJO...



OLR anomalies associated with MJO (winter time)



Index of MJO is based on a pair of empirical orthogonal functions (EOFs) of the combined fields of near-equatorially-averaged 850 hPa zonal wind, 200 hPa zonal wind, and 200 hPa velocity potential data.

The pair of PC time series that form the index the Real-time Multivariate MJO series 1 (RMM1), and 2 (RMM2). Removed the impact of ENSO with Nino.3 index.

(mainly based on Wheeler and Hendon (2004))

About wave activity flux...

- Formulation

$$W = \frac{p}{2|U|} \left(\begin{array}{l} U (\psi'^2_x - \psi' \psi'_{xx}) + V (\psi'_x \psi'_y - \psi' \psi'_{xy}) \\ U (\psi'_x \psi'_y - \psi' \psi'_{xy}) + V (\psi'^2_y - \psi' \psi'_{yy}) \\ \frac{f_0^2}{N^2} [U (\psi'_x \psi'_z - \psi' \psi'_{xz}) + V (\psi'_y \psi'_z - \psi' \psi'_{yz})] \end{array} \right) + C_U M$$

where, $p = (\text{pressure})/1000\text{hPa}$, $|U|$ is wind speed, ψ' means the anomaly of stream function.

C_U is phase propagation in the direction of wind.

M pseudomomentum.

- Interpretation

- Wave activity flux W is parallel to the group velocity of quasi-stationary Rossby wave.
- The divergence of W leads to realistic estimation of a wave source region.

For more detail, please refer to Takaya and Nakamura (2001, JAS)