

Monthly Highlights on Climate System (June 2009)

Highlights in June 2009

- Monthly sunshine durations were below normal in Northern Japan. Monthly precipitation amounts were below normal in Western Japan and on the Sea of Japan side of Eastern Japan.
- Monthly mean temperatures were extremely high from India to Western Japan.
- The delay in the development of the Tibetan High and the southward shift of the sub-tropical jet were remarkable from northern Africa to around India.
- Convective activities in the tropics were enhanced near the Philippines while they were suppressed near India.
- Positive SST anomalies dominated in most of the equatorial Pacific.

Climate in Japan (Fig. 1):

Frequent passage of cyclones caused cloudy and rainy weather in Northern Japan where monthly sunshine durations were below normal. Since the Baiu front tended to stay away from Honshu, monthly precipitation amounts were below normal in Western Japan and on the Sea of Japan side of Eastern Japan.

World Climate (Figs. 2 and 3):

The [monthly anomaly of the global average surface temperature in June 2009](#) (i.e. the average of the near-surface air temperature over land and the SST) was +0.36 °C (2nd highest since 1891) (Fig. 2). On a longer time scale, global average surface temperatures have been rising at a rate of about 0.64°C per century.

- Monthly mean temperatures were extremely high from India to Western Japan (Fig.3).
- Monthly mean temperatures were extremely high from western Kazakhstan to the Middle East due to southerly warm winds in the west of high pressure system.
- Monthly precipitation amounts were extremely heavy along the west shore of northern Africa due to enhanced convection.
- Monthly precipitation amounts were extremely heavy in the northern USA due to stationary fronts.

Extratropics (Figs. 4 and 5):

In the 200-hPa wind field, the southward shift of the sub-tropical jet was remarkable from northern Africa to around India, which was related to the delay in the development of the Tibetan High (Fig. 4). High frequency disturbances were generally less active than their normal in a northward shifted position. In the 500-hPa height field, positive and negative anomalies were dominant in the high and middle latitudes, respectively (Fig. 5). In the lower troposphere, remarkable high temperature anomalies were observed over western Russia and eastern Siberia in association with the development of an upper-tropospheric ridge. They were also observed in China. On the other hand, low temperature anomalies were observed in western Siberia and central Asia due to the development of an upper-tropospheric trough and a surface high pressure system accompanied with a cold air mass.

Tropics (Figs. 6, 7 and 8):

Convective activities in the tropics were enhanced near the Philippines and over northern South America while they were suppressed near India and over western Indonesia (Fig. 6). Tropical cyclones "LINFA" and "NANGKA" formed near the Philippines. In the lower troposphere, weaker-than-normal Somali jet was observed over the western Indian Ocean. This indicates that the Indian monsoon circulation was weaker than normal. The North Pacific High was weaker than normal and westerly wind anomalies were observed over the equatorial Pacific. In the upper troposphere, cyclonic circulation anomalies were observed from northern Africa to the Middle East (Fig. 8). This indicates that the Tibetan High was weaker than normal in its western side. Though the active phase of the Madden-Julian Oscillation (MJO) propagated from the western Pacific to South America and Africa from early to middle June, its propagation became obscure afterward (Fig. 7). The Southern Oscillation Index (SOI) was 0.0.

Oceanographic Conditions (Figs. 9 and 10):

Positive SST anomalies dominated in most of the equatorial Pacific and they were remarkable in the eastern part (Fig. 9). The monthly mean SST anomaly was +0.8°C in the NINO.3 region (+0.7°C deviated from the latest sliding 30-year mean SST for the same region (Fig. 10)).

In the North Pacific, positive SST anomalies were found from 10°N, 140°E to the Hawaiian Islands, and from the date line around 45°N to near the west coast of North America. Negative SST anomalies were found from the north of the Philippines to around Japan. In the South Pacific, positive SST anomalies were found near the west coast of South America and around 40°S, 155°W.

In the Indian Ocean, positive SST anomalies were found around Indonesia and from near the east coast of Africa to off western Australia.

In the Atlantic, positive SST anomalies were found to the south of the equator, near the east coast of North America and from Western Sahara to the north of the U.K.

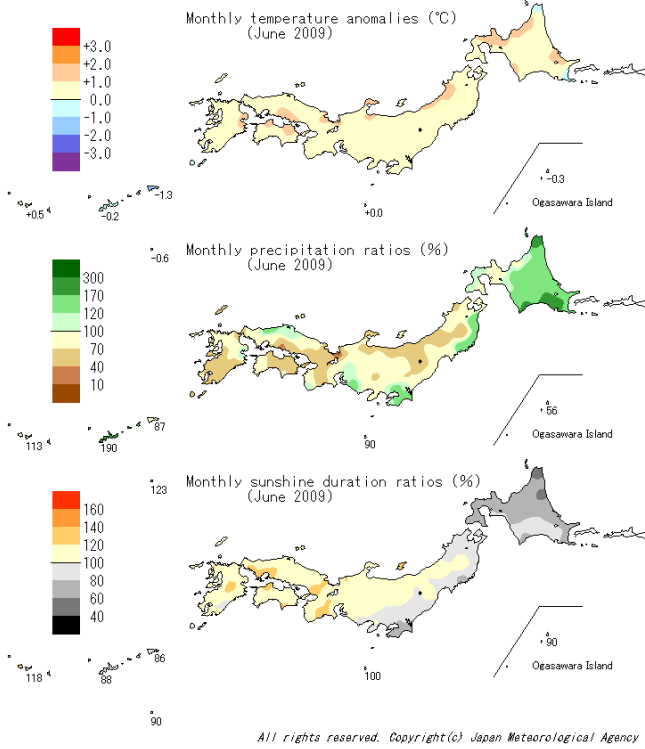


Fig. 1 Monthly climate anomaly / ratio over Japan (June 2009)

Top: temperature anomalies (degree C)
Middle: Precipitation ratio (%)
Bottom: Sunshine duration ratio (%)
Anomalies are defined as the deviations from the normal (1971-2000 average).

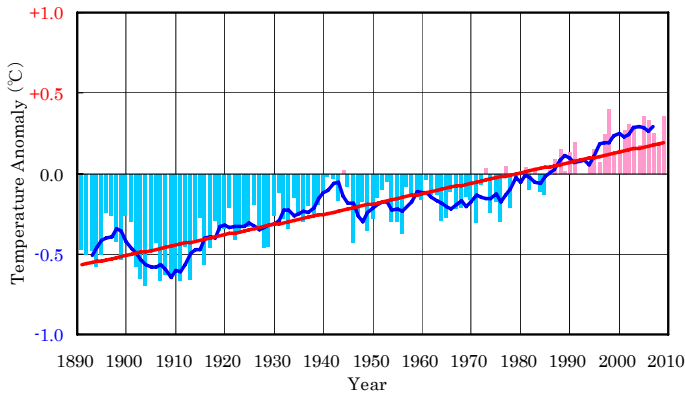


Fig. 2 Long-term change in monthly mean surface temperature anomalies in June over the globe

The bars indicate anomalies of surface temperature in each year. The blue line indicates 5-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations from the normal (1971-2000 average).

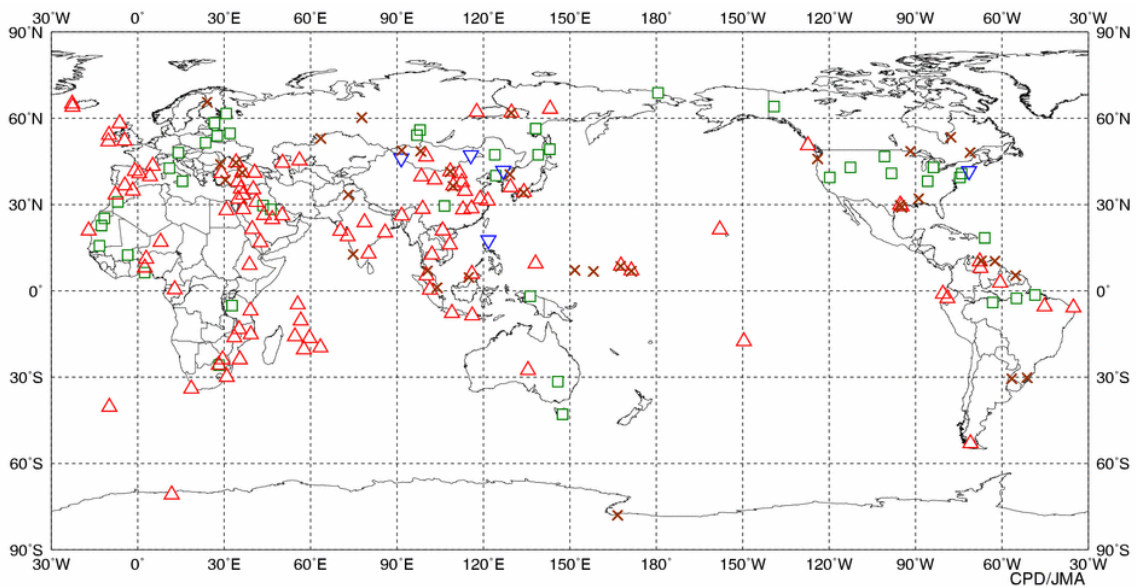


Fig. 3 Distribution of extreme climate events (June 2009)

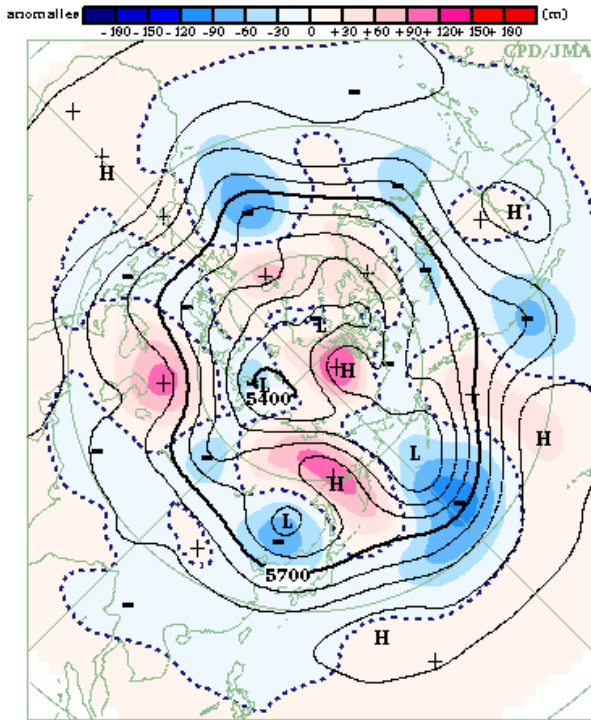


Fig. 4 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (June 2009)
 Contours show heights at an interval of 60 m. Shaded patterns show height anomalies. Base period for the normal is 1979-2004.

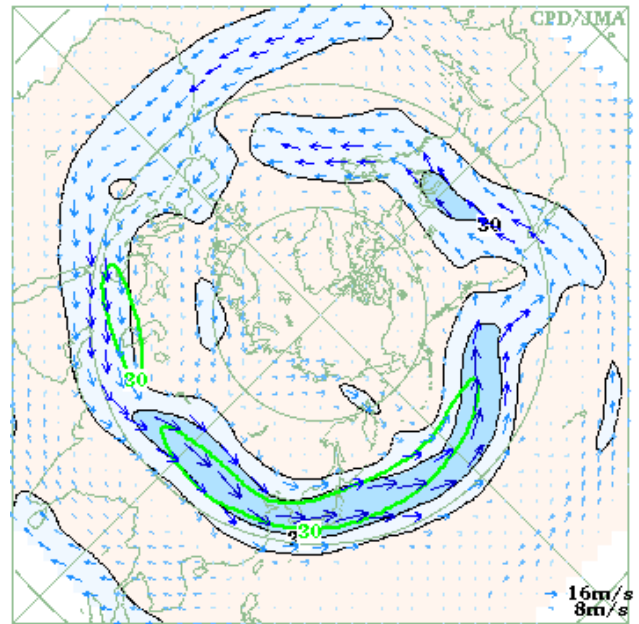


Fig. 5 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (June 2009)
 Black lines show wind speeds at an interval of 15 m/s. Blue shading shows values greater than 30 m/s. Green lines show normal wind speeds at an interval of 30 m/s. Base period for the normal is 1979-2004.

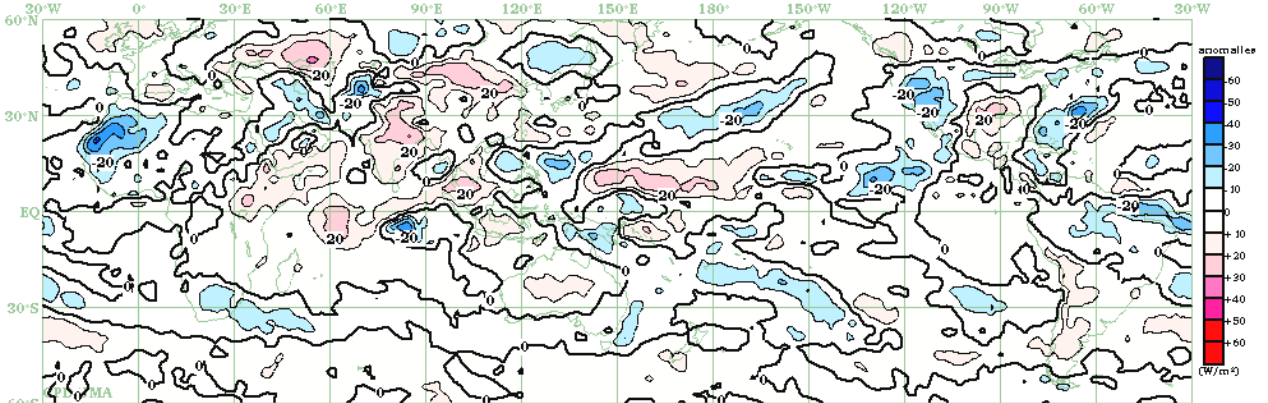


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (June 2009)
 Contour interval is 10 W/m². Base period for the normal is 1979-2004. Original data are provided by courtesy of CDC/NOAA.

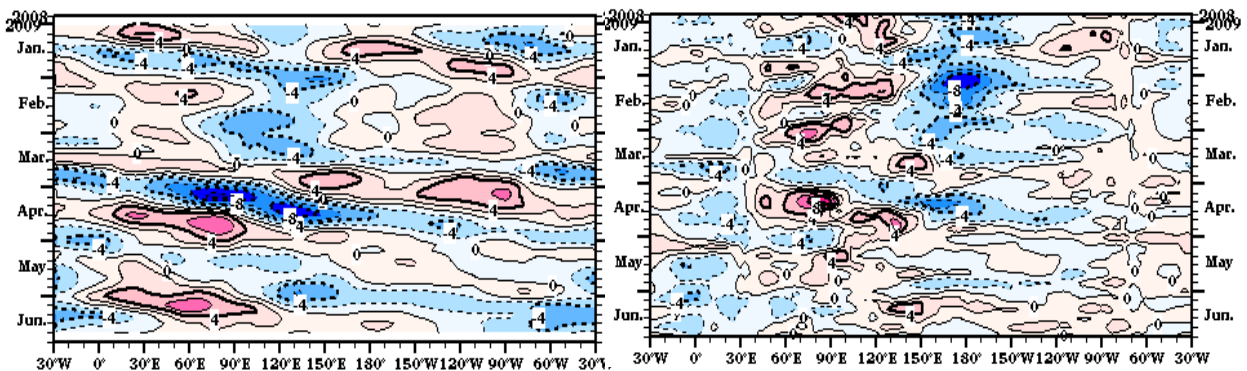


Fig. 7 Time-Longitude cross section (5°N-5°S) of 5-day mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (January – June 2009)
 Contour interval is 2x10⁶ m²/s (left) and 2 m/s (right). Base period for the normal is 1979-2004.

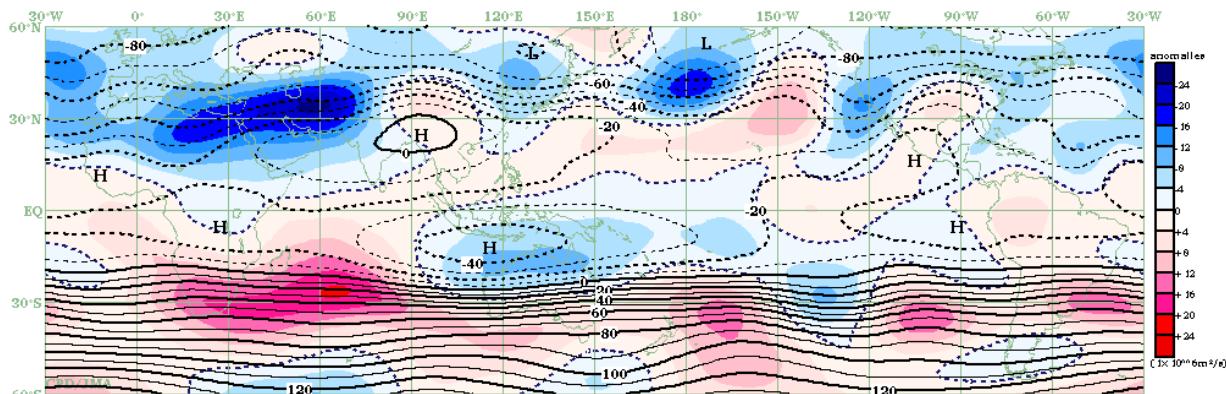


Fig. 8 Monthly mean 200-hPa stream function and anomaly (June 2009)
Contour interval is $10 \times 10^6 \text{ m}^2/\text{s}$. Base period for the normal is 1979-2004.

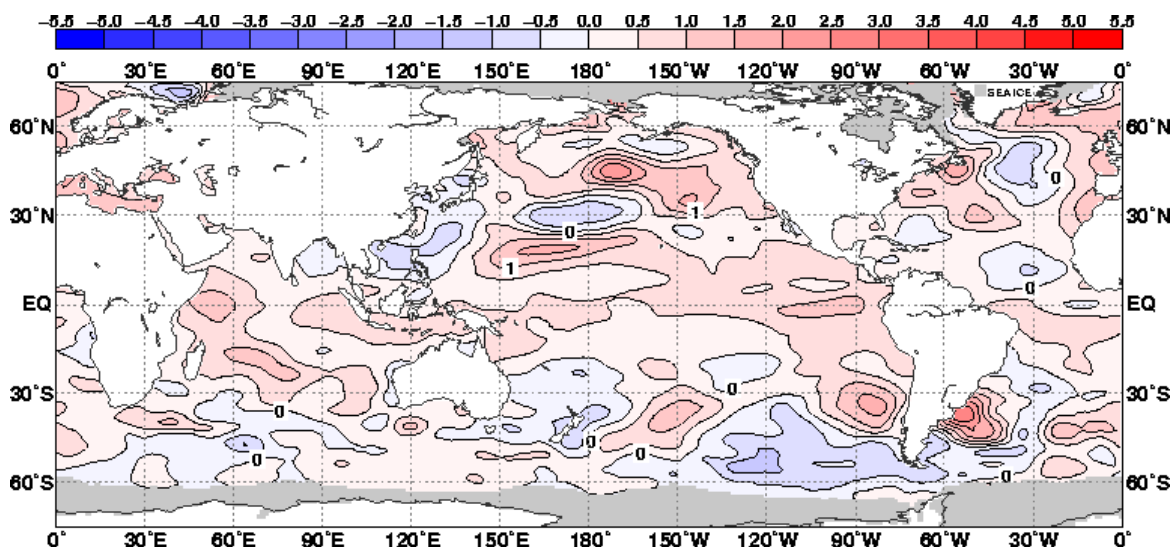


Fig. 9 Monthly mean sea surface temperature anomaly (June 2009)
Contour interval is 0.5 degree C. Base period for the normal is 1971-2000. Maximum coverage with sea ice is shaded in gray.

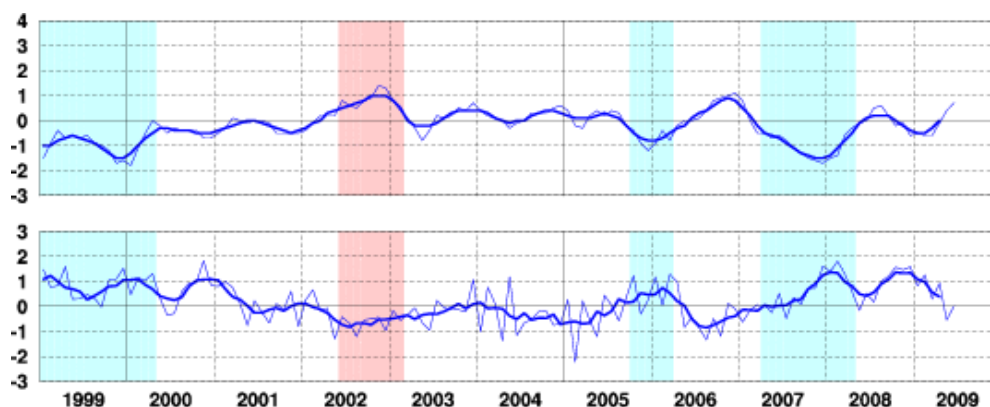


Fig. 10 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST, averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1971-2000 base period (lower). Thin blue lines represent monthly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

Detailed information on the climate system is available on the Tokyo Climate Center's website (<http://ds.data.jma.go.jp/tcc/tcc/index.html>)
This report is prepared by the Climate Prediction Division, Global Environment and Marine Department, Japan Meteorological Agency.