

Monthly Highlights on the Climate System (September 2017)

Highlights in September 2017

- Monthly mean temperature in Okinawa/Amami tied with 2014 as the highest on record for September since 1946.
- Monthly sunshine durations were significantly above normal in northern Japan and on the Sea of Japan side of eastern Japan.
- Monthly mean temperatures were extremely high from southeastern Europe to Turkey, from Norway to northeastern Greenland, and from Mauritius to northern Mozambique.
- In the equatorial Pacific, remarkably positive SST anomalies were observed in the western part and negative SST anomalies were observed from the central part to the eastern part.
- Convective activity was enhanced around the Maritime Continent and the western North Atlantic.
- The jet stream displaced southward from its normal position over the area from Japan to the Pacific.
- The Pacific High extended to the south of Japan.

Climate in Japan (Fig. 1):

- In Okinawa/Amami, monthly mean temperature tied with 2014 as the highest on record for September since 1946, as well as monthly sunshine durations were above normal, since the Pacific High extended to the south of Japan.
- Monthly sunshine durations were significantly above normal in northern Japan and on the Sea of Japan side of eastern Japan, since high-pressure systems tended to cover the regions. On the other hand, monthly sunshine durations were below normal in western Japan due to fronts and moist air inflow.
- In the middle of September, northern Japan, eastern Japan and Okinawa/Amami experienced heavy rain that caused river overflows and landslides, due to the approach of the typhoon TALIM.

World Climate:

- The monthly anomaly of the global average surface temperature in September 2017 (i.e., the combined average of the near-surface air temperature over land and the SST) was $+0.34^{\circ}\text{C}$ (4th warmest since 1891) (preliminary value) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.65°C per century in September (preliminary value).
- Extreme climate events were as follows (Fig. 3).
 - Monthly mean temperatures were extremely high from Okinawa region of Japan to southeastern China.
 - Monthly mean temperatures were extremely high from southeastern Europe to Turkey and from Norway to northeastern Greenland.
 - Monthly precipitation amounts were extremely high in eastern Europe, and were extremely low from the Iberian Peninsula to northern Algeria.
 - Monthly mean temperatures were extremely high from Mauritius to northern Mozambique.

Oceanographic Conditions (Fig. 4):

- In the equatorial Pacific, remarkably positive SST anomalies were observed in the western part and negative SST anomalies were observed from the central part to the eastern part. In the NINO.3 region, the monthly mean SST anomaly was -0.7°C and the SST deviation from the latest sliding 30-year mean was -0.8°C (Fig. 5).
- In the North Pacific, remarkably positive SST anomalies were observed from the western tropical region to south of Japan and from the western tropical region to the area near the western coast of North America, and in the Bering Sea.
- In the South Pacific, remarkably positive SST anomalies were observed east of New Zealand.

- In the Indian Ocean, remarkably positive SST anomalies were observed from the eastern coast of East Africa to the area near 30°S, 100°E, in the Arabian Sea, and in the Bay of Bengal.
- In the North Atlantic, remarkably positive SST anomalies were observed from the area near the eastern coast of the USA to the area near 45°N, 10°W and from the area near 15°N, 45°W to the western coast of West Africa.

Tropics:

- Convective activity was enhanced around the Maritime Continent and the western North Atlantic, and was suppressed over the South China Sea and the latitude bands of 20°N in the western North Pacific (Fig. 6).
- The active phase of equatorial intraseasonal oscillations propagated eastward from the Indian Ocean to the Maritime Continent during the first half of September (Fig. 7).
- In the upper troposphere, anti-cyclonic circulation anomalies were observed over a wide area of the Indian Ocean (Fig.8). The Tibetan High was stronger than normal over its northeastern part.
- In the lower troposphere, anti-cyclonic circulation anomalies were observed over a wide area of the Pacific.
- In the sea level pressure field, positive anomalies were observed over the seas south of Japan, and negative anomalies were observed over the Indian Ocean. The Southern Oscillation Index value was +0.6 (Fig. 5).

Extratropics:

- In the 500-hPa height field (Fig. 9), wave trains were observed from the North Atlantic to Central Siberia with clear positive anomalies over the Barents Sea and negative anomalies over central Europe and the southern part of Central Siberia. Meanwhile, around Japan, positive anomalies were observed from eastern China to the seas south of Japan and negative anomalies were observed over northern Japan.
- The jet stream in the Northern Hemisphere was stronger than normal over China and displaced southward from its normal position over the area from Japan to the Pacific (Fig. 10).
- In the sea level pressure field (Fig. 11), positive and negative anomalies were clearly observed over the Barents Sea and the western part of Eastern Siberia, respectively. The Pacific High extended to the south of Japan.
- Temperatures at 850-hPa were above normal to the east of Greenland, from eastern Europe to Turkey, and over eastern China, and below normal over western Europe and Western Siberia (Fig. 12).
- Zonal mean temperatures in the troposphere were above normal except over the high-latitudes in the Southern Hemisphere.

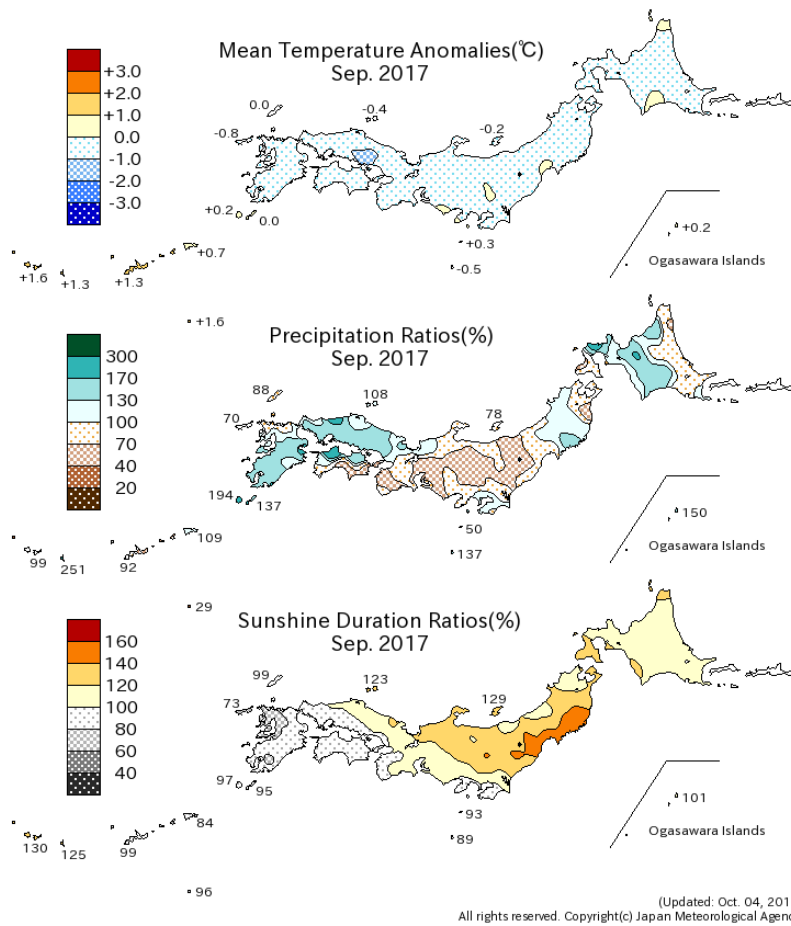


Fig. 1 Monthly climate anomaly/ratio over Japan (September 2017)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1981-2010.

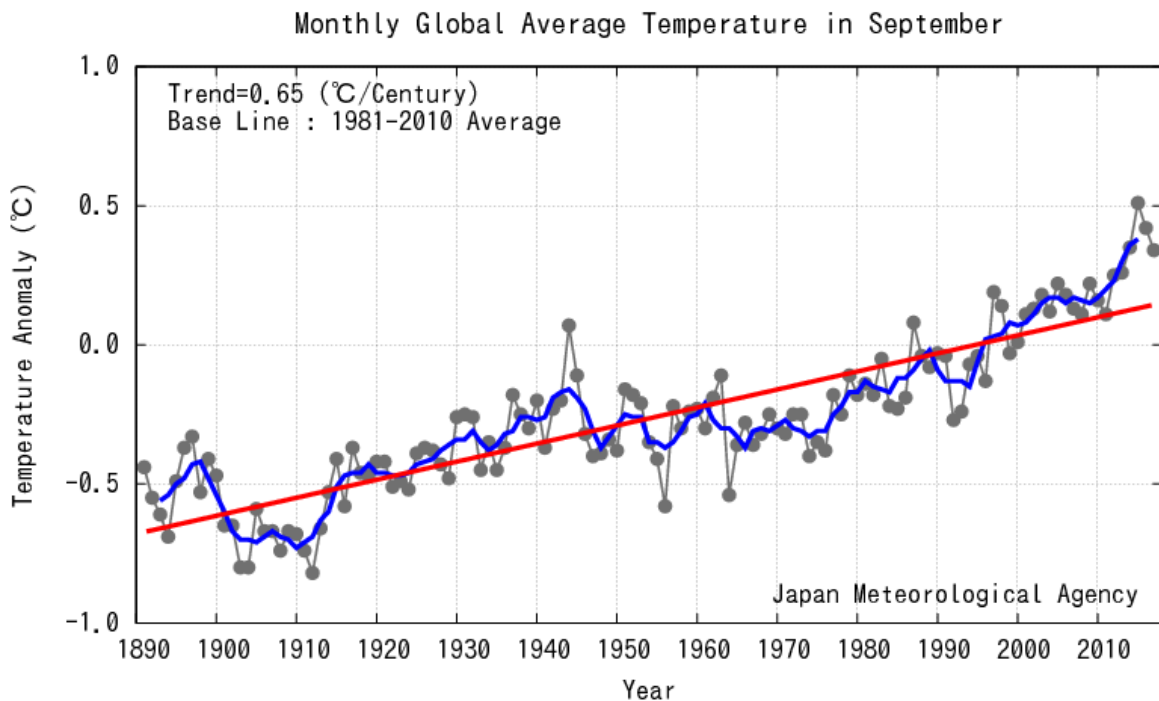


Fig. 2 Long-term change in monthly anomalies of global average surface temperature in September
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations from the 1981-2010 average.

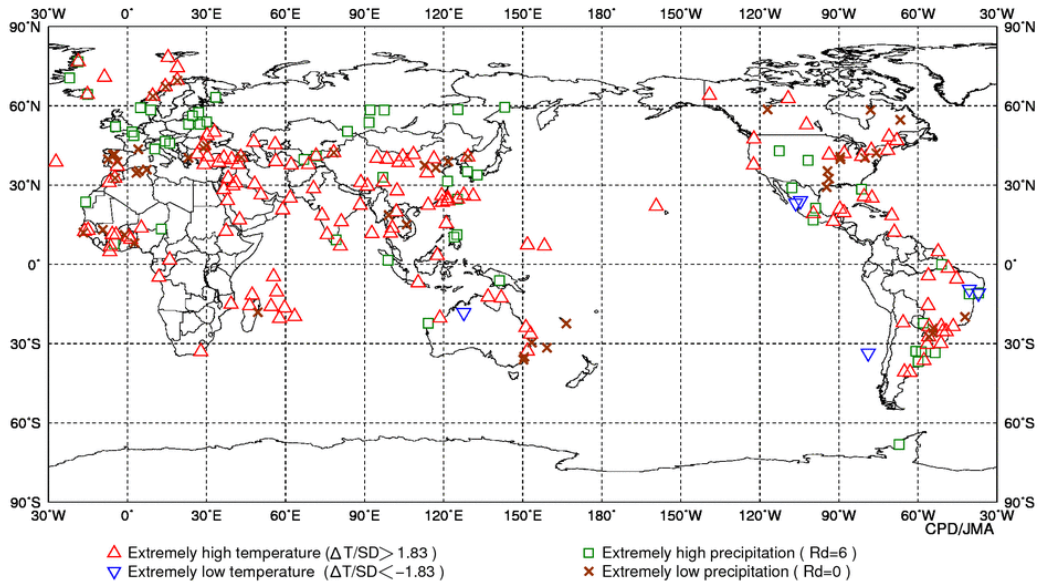


Fig. 3 Distribution of extreme climate events (September 2017)

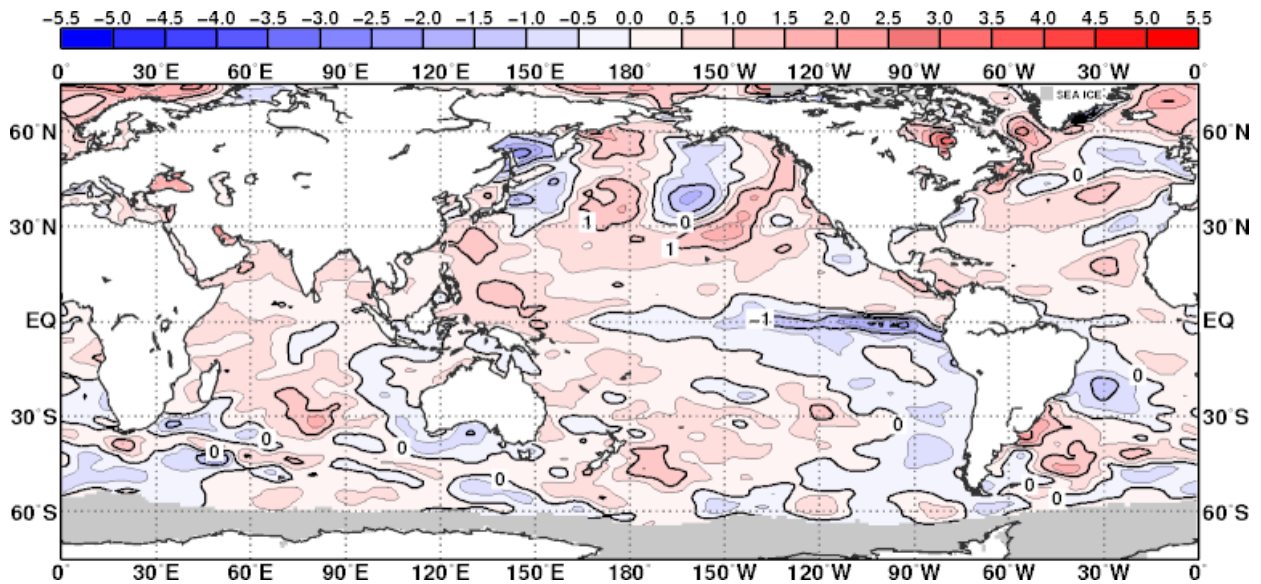


Fig. 4 Monthly mean sea surface temperature anomaly (September 2017)

The contour interval is 0.5 degree C. The base period for the normal is 1981-2010. Maximum coverage with sea ice is shaded in gray.

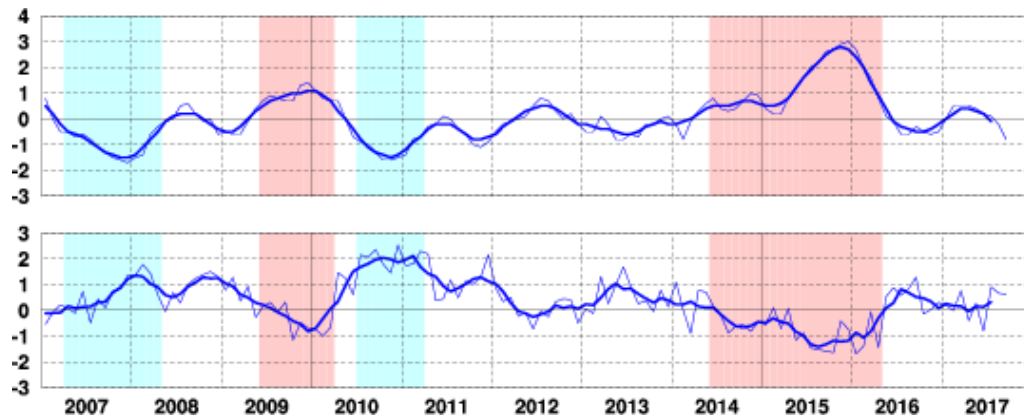


Fig. 5 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1981-2010 base period (lower).

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

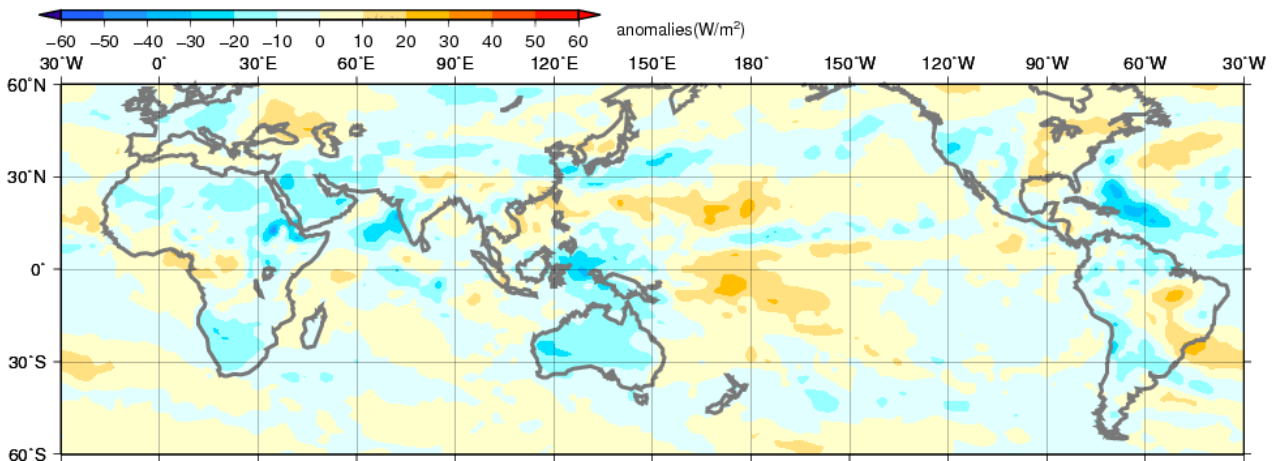


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (September 2017)
 The contour interval is 10 W/m². The base period for the normal is 1981-2010. Original data provided by NOAA.

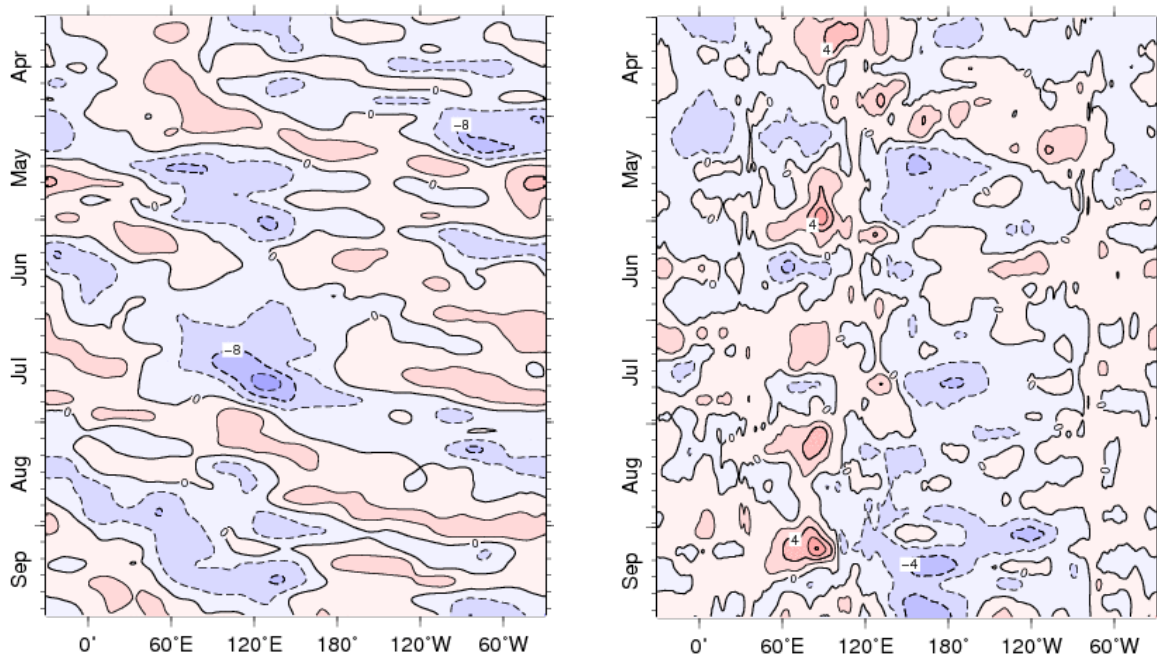


Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (April 2017 – September 2017)
 The contour intervals are 4×10^6 m²/s (left) and 2 m/s (right). The base period for the normal is 1981-2010.

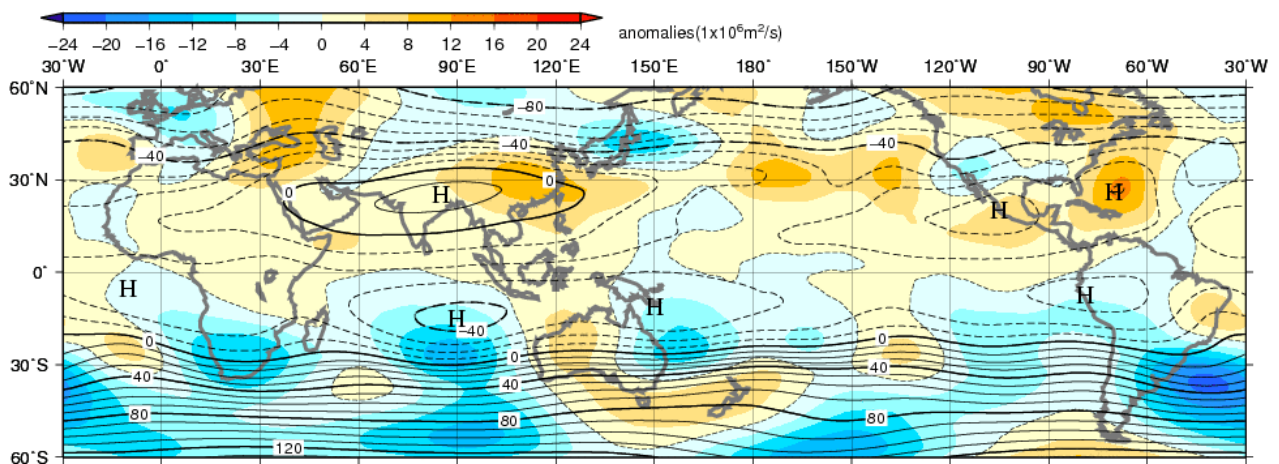


Fig. 8 Monthly mean 200-hPa stream function and anomaly (September 2017)
 The contour interval is 10×10^6 m²/s. The base period for the normal is 1981-2010.

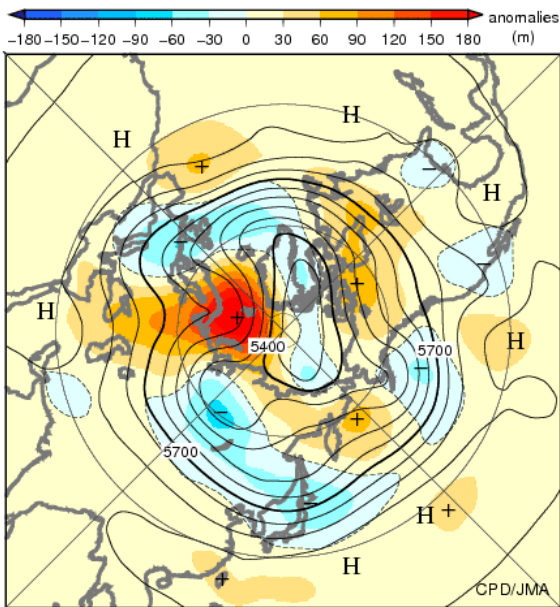


Fig. 9 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (September 2017)

The contours show 500-hPa height at intervals of 60 m. The shading indicates its anomalies. The base period for the normal is 1981-2010.

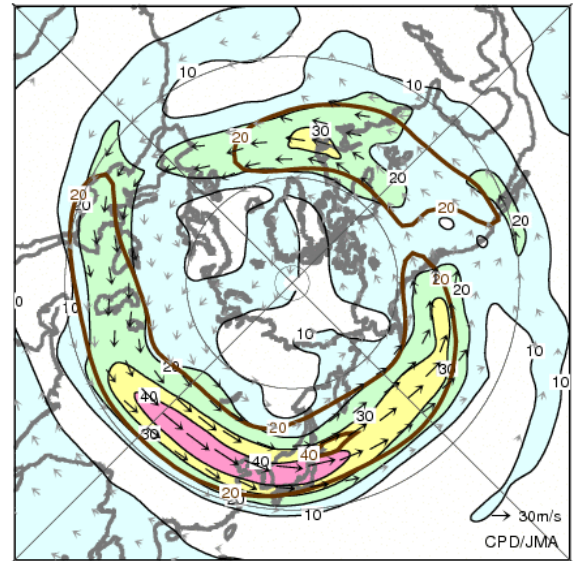


Fig. 10 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (September 2017)

The black lines show wind speed at intervals of 10 m/s. The brown lines show its normal at intervals of 20 m/s. The base period for the normal is 1981-2010.

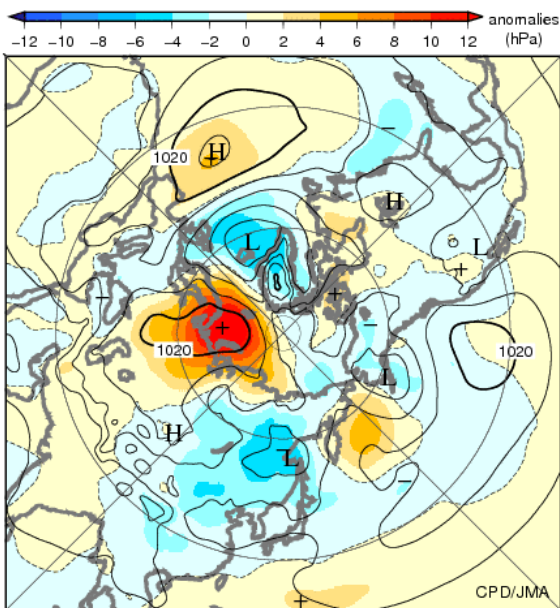


Fig. 11 Monthly mean sea level pressure and anomaly in the Northern Hemisphere (September 2017)

The contours show sea level pressure at intervals of 4 hPa. The shading indicates its anomalies. The base period for the normal is 1981-2010.

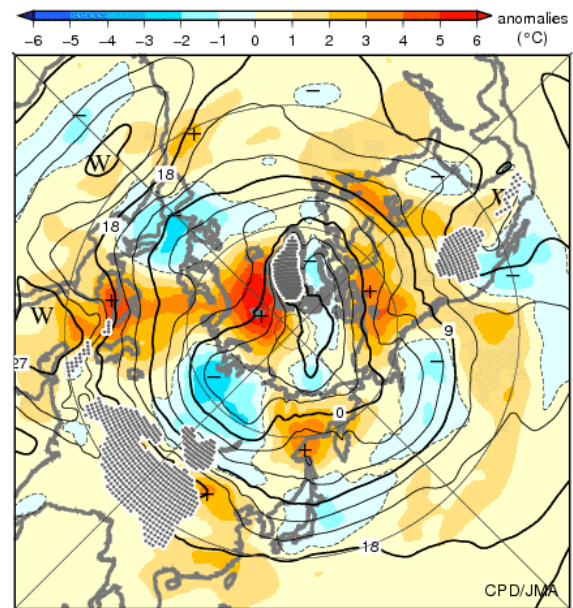


Fig. 12 Monthly mean 850-hPa temperature and anomaly in the Northern Hemisphere (September 2017)

The contours show 850-hPa temperature at intervals of 3 degree C. The shading indicates its anomalies. The base period for the normal is 1981-2010.

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 Tokyo Climate Center, Climate Prediction Division, Global Environment and Marine Department, Japan Meteorological Agency.