

Monthly Highlights on the Climate System (October 2021)

Highlights in October 2021

- La Niña conditions are considered to be present in the equatorial Pacific (see [El Niño Outlook](#) updated on 10 November 2021).
- In Japan, temperatures were above normal in the first half of the month but below normal afterward. Monthly precipitation amounts were significantly above normal on the Sea of Japan side of northern Japan.
- Monthly mean temperatures were extremely high from the northeastern part of North America to the central part of Central America and from northern to eastern Australia.
- Convective activity was enhanced over the latitude band of 10°N to 20°N from India to the central North Pacific, and suppressed over the western tropical Indian Ocean and the western to central equatorial Pacific.
- In the 500-hPa height field, a wave train was dominant from the mid-latitude North Pacific via northern North America to the Mediterranean Sea, with significantly positive anomalies over northeastern Canada.
- The subtropical jet stream over Eurasia shifted northward from its normal position. The westerly jet stream over the mid-latitude North Pacific also shifted northward from its normal position.

Notice: The new climatological normal (1991-2020 average) has been used unless otherwise stated.

Climate in Japan (Fig. 1):

- The first half of October brought notably warmer than normal temperatures nationwide, due to warm air advection for northern Japan, and in addition to this, sunny conditions associated with frequent high pressure systems for the other regions in the country. Later in the month, however, temperatures sharply dropped in most of the country because of air mass inflow from the continent very cold for this time of the year. In aggregate monthly mean temperatures were above normal in eastern to western Japan and Okinawa/Amami.
- Monthly precipitation amounts were significantly above normal on the Sea of Japan side of northern Japan due to influences from low pressure systems and fronts. Monthly precipitation amounts were below normal and monthly sunshine durations were above normal in most of eastern to western Japan, significantly so in some regions, due to high pressure systems frequently seen settling over the area.

World Climate:

- The monthly anomaly of the global average surface temperature (i.e., the combined average of the near-surface air temperature over land and the SST) was +0.30°C (3rd warmest for October since 1891) (preliminary value) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.66°C per century in October (preliminary value).
- Extreme climate events were as follows (Fig. 3).
 - Monthly mean temperatures were extremely high from the northwestern part of Eastern Siberia to the central part of Central Siberia, from southwestern China to northern Bangladesh, from New Guinea Island to Sumatra Island, in western Saudi Arabia, from the northeastern part of North America to the central part of Central America, from central Peru to western Bolivia, from northern to eastern Australia, and on the Indian Ocean coast of Antarctica.
 - Monthly mean temperatures were extremely low from western China to the southern part of Central Asia.
 - Monthly precipitation amounts were extremely high from the northwestern part of Eastern Siberia to the northeastern part of Central Siberia, from Hokkaido region of Japan to central China, from southeastern China to the central Indochina Peninsula, in and around the northwestern part of South Asia, in northern and northwestern Europe, in the south area of the Great Lakes, and in the western USA.
 - Monthly precipitation amounts were extremely low from the central part of Eastern Siberia to the southeastern part of Western Siberia, from southwestern Russia to central Europe, and in and around the

northwestern part of Northern Africa.

Oceanographic Conditions (Fig. 4):

- In the equatorial Pacific, remarkably positive SST anomalies were observed west of 150°E, and remarkably negative SST anomalies were observed in the central part. The monthly mean SST anomaly averaged over the NINO.3 region and the SST deviation from the latest sliding 30-year mean over the region were both -0.7°C (Fig. 5).
- In the North Pacific, remarkably positive SST anomalies were observed in the central part and the western tropical region, and remarkably negative SST anomalies were observed in the Gulf of Alaska and from the area near Hawaii to the western coast of the USA.
- In the South Pacific, remarkably positive SST anomalies were observed in the western tropical region and in the area near 30°S, 140°W, and remarkably negative SST anomalies were observed from the central to eastern tropical region.
- In the Indian Ocean, remarkably positive SST anomalies were observed west of Sumatra.
- In the North Atlantic, remarkably positive SST anomalies were observed off the eastern coast of North America and from the area near 30°N, 50°W to the western coast of Europe. Remarkably positive SST anomalies were also observed in the equatorial Atlantic.

Tropics:

- Convective activity was enhanced over the latitude band of 10°N to 20°N from India to the central North Pacific, and suppressed over the western tropical Indian Ocean, the western to central equatorial Pacific and the latitude band of 10°N to 20°N in the tropical North Atlantic (Fig. 6).
- The active phase of equatorial intraseasonal oscillation propagated eastward from the Maritime Continent to the western Pacific in the first half of the month, and became obscure afterward (Fig. 7).
- In the upper troposphere, anti-cyclonic circulation anomalies straddling the equator were seen from the tropical Atlantic to the tropical Indian Ocean, and cyclonic circulation anomalies straddling the equator were seen around the date line in the tropical Pacific (Fig. 8).
- In the lower troposphere, cyclonic circulation anomalies straddling the equator were seen from the tropical Indian Ocean to the Maritime Continent and over the central to eastern tropical Atlantic, and anti-cyclonic circulation anomalies straddling the equator were seen over the central tropical Pacific.
- In the sea level pressure field, in the equatorial area, positive anomalies were seen from near the date line to South America, and negative anomalies were seen over the Atlantic and from the Indian Ocean to the Maritime Continent. The Southern Oscillation Index value was +0.8 (Fig. 5).

Extratropics:

- In the 500-hPa height field (Fig. 9), a wave train was dominant from the mid-latitude North Pacific via northern North America to the Mediterranean Sea, with significantly positive anomalies to the south of the Aleutian Islands and over northeastern Canada.
- The subtropical jet stream over Eurasia shifted northward from its normal position. The westerly jet stream over the mid-latitude North Pacific also shifted northward from its normal position (Fig. 10).
- In the sea level pressure field (Fig. 11), positive anomalies were seen over a wide area of mid-latitude Eurasia, and negative anomalies were seen from Alaska to northwestern Canada.
- Temperatures at 850-hPa were below normal over a wide area of mid-latitude Eurasia, and above normal over northern North America and to the south of the Aleutian Islands (Fig. 12).
- Zonal mean temperatures in the troposphere were generally above normal, with significantly positive anomalies over the latitude band of 70°N. In the stratosphere, zonal mean temperatures were above normal in the Northern Hemisphere high-latitudes, and below normal in the Southern Hemisphere high-latitudes.

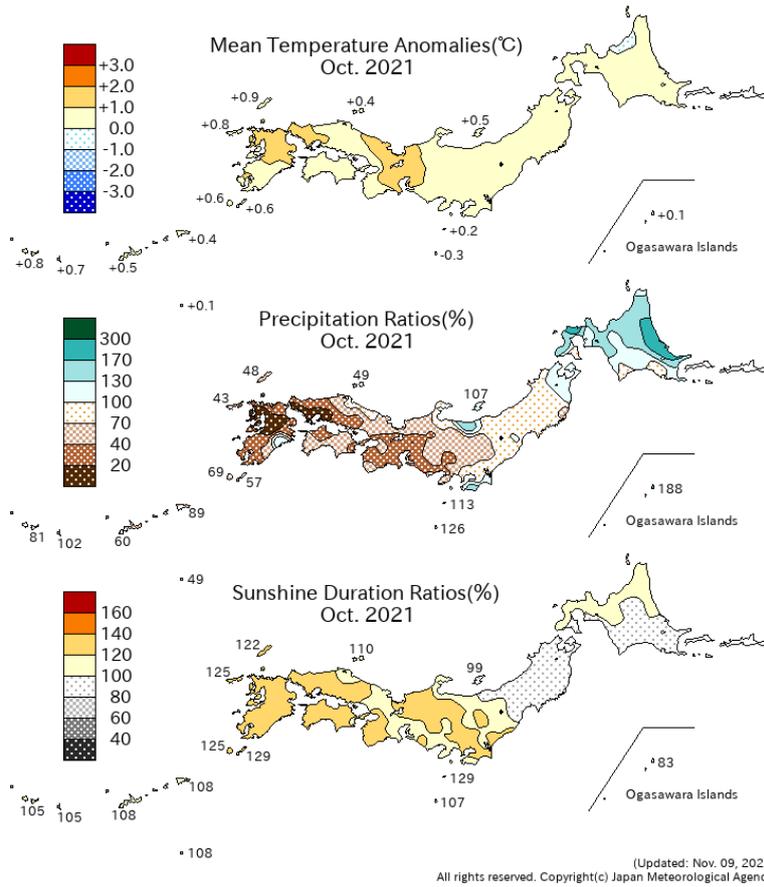


Fig. 1 Monthly climate anomaly/ratio over Japan (October 2021)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1991-2020.

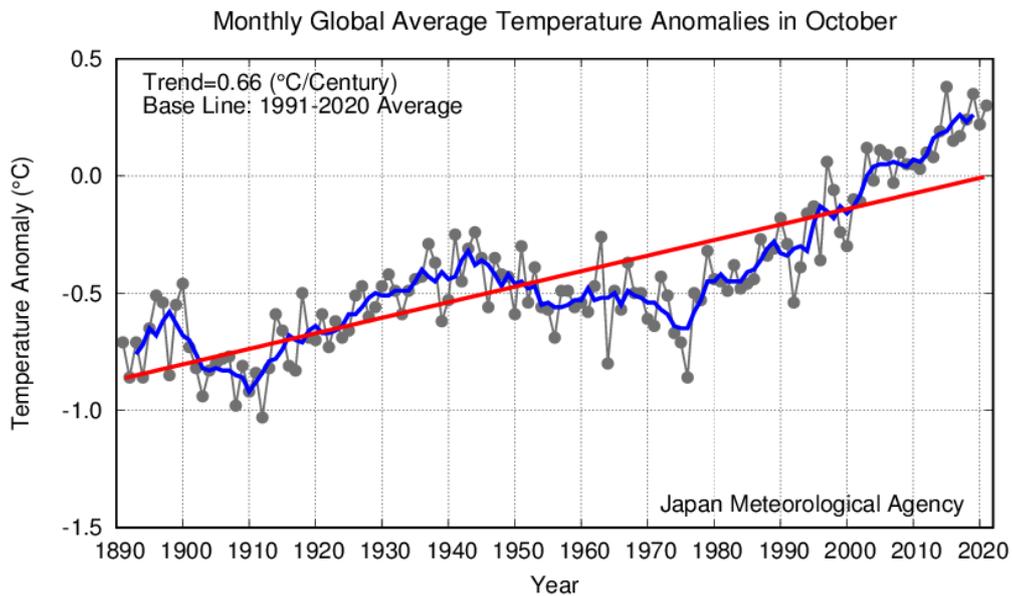


Fig. 2 Long-term change in monthly anomalies of global average surface temperature in October
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations from the 1991-2020 average.

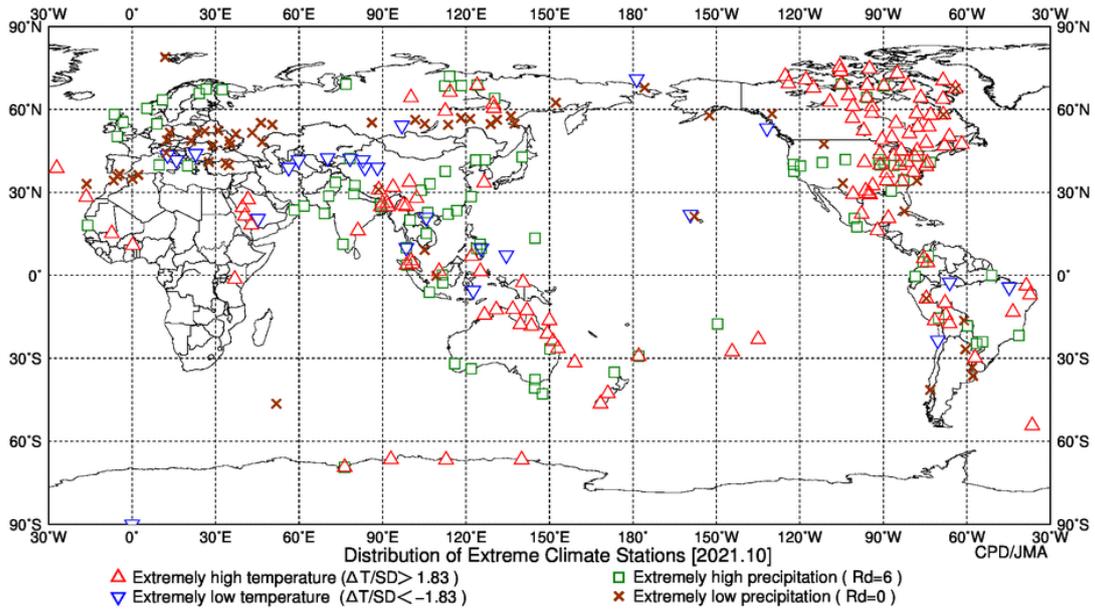


Fig. 3 Distribution of extreme climate stations (October 2021)

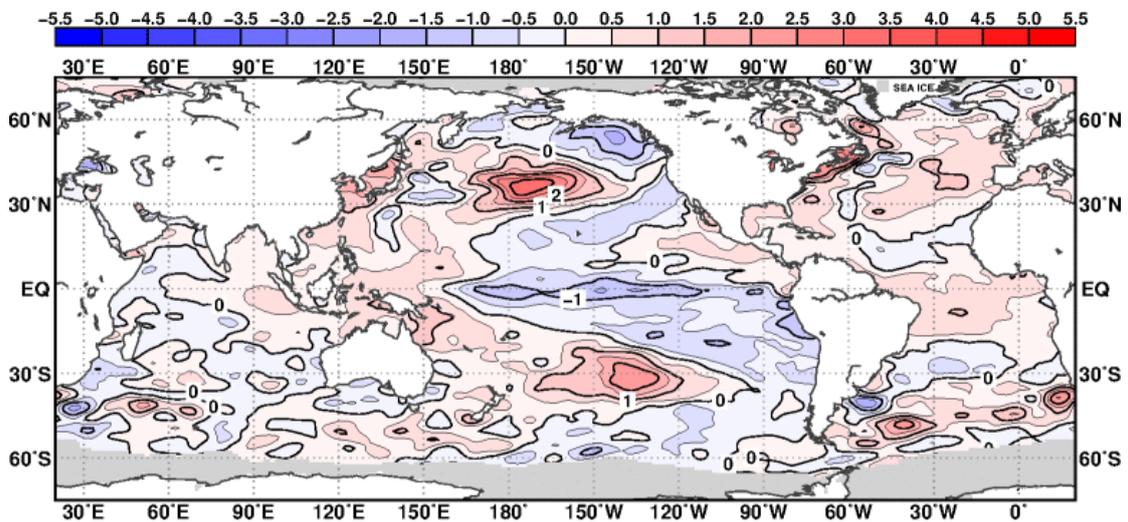


Fig. 4 Monthly mean sea surface temperature anomaly (October 2021)
The contour interval is 0.5 degree C. The base period for the normal is 1991-2020. Maximum coverage with sea ice is shaded in gray.

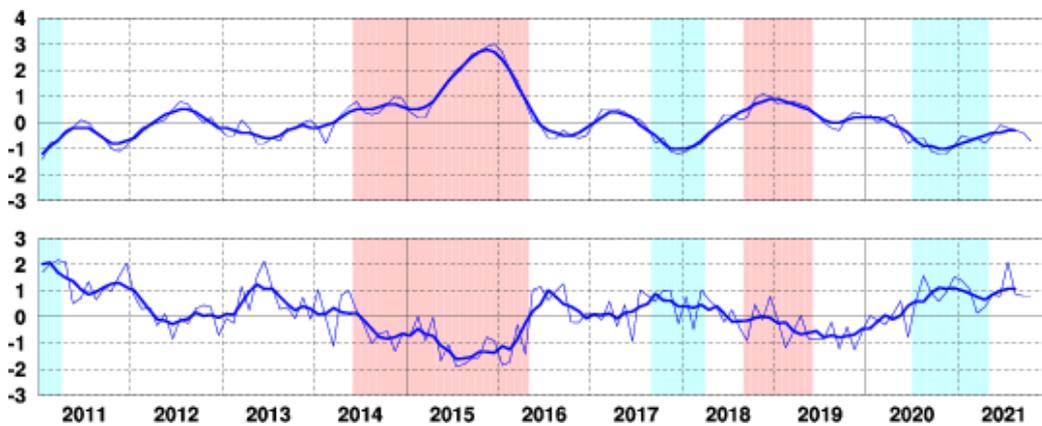


Fig. 5 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1991-2020 base period (lower). Thin blue lines represent monthly 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.

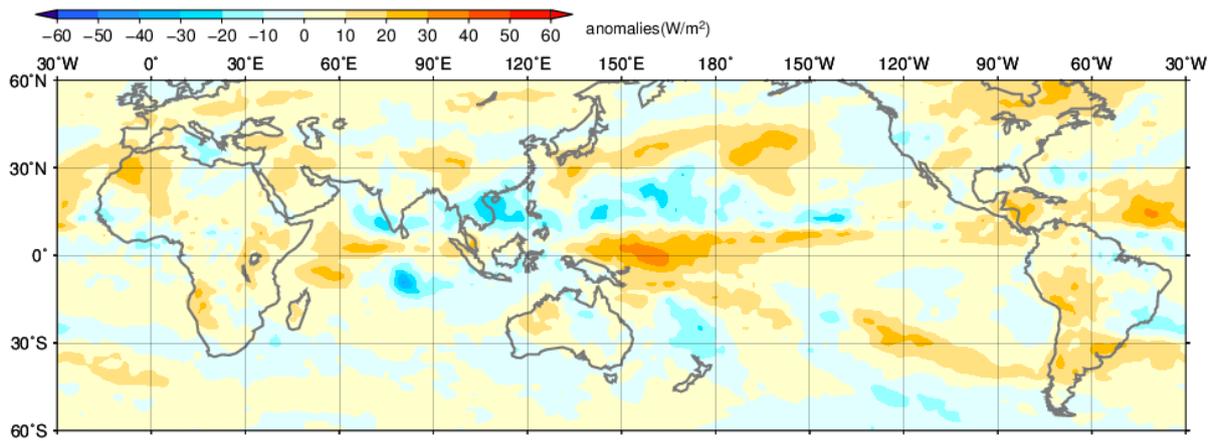


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (October 2021)
The contour interval is 10 W/m². The base period for the normal is 1991-2020. Original data provided by NOAA.

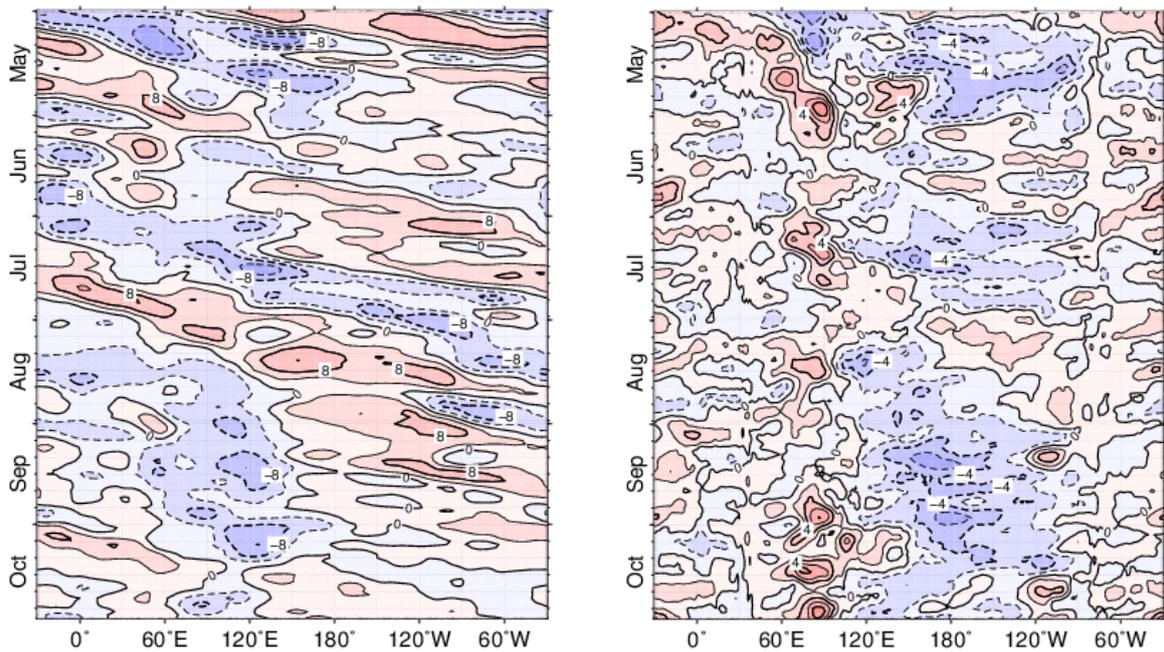


Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (May 2021 – October 2021)
The contour intervals are 4x10⁶ m²/s (left) and 2 m/s (right). The base period for the normal is 1991-2020.

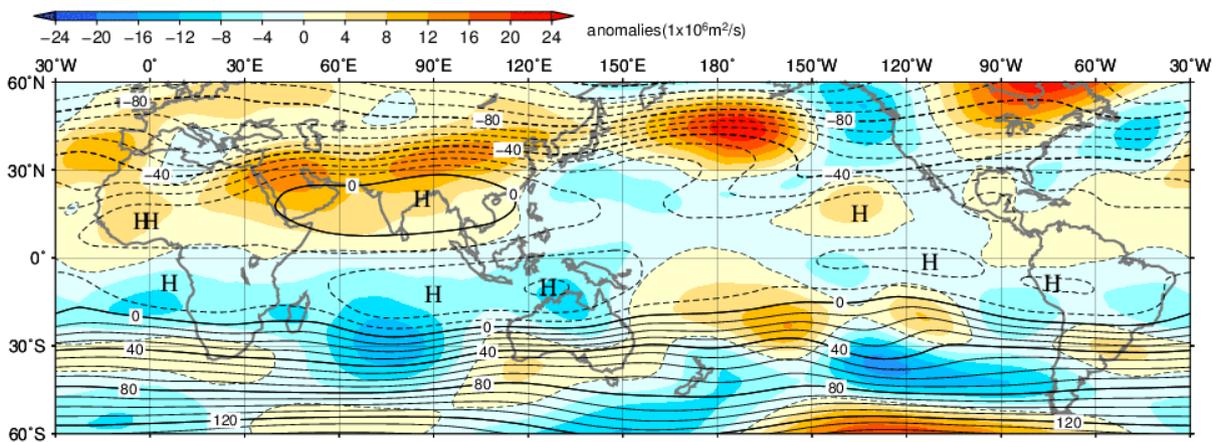


Fig. 8 Monthly mean 200-hPa stream function and anomaly (October 2021)
The contour interval is 10x10⁶ m²/s. The base period for the normal is 1991-2020.

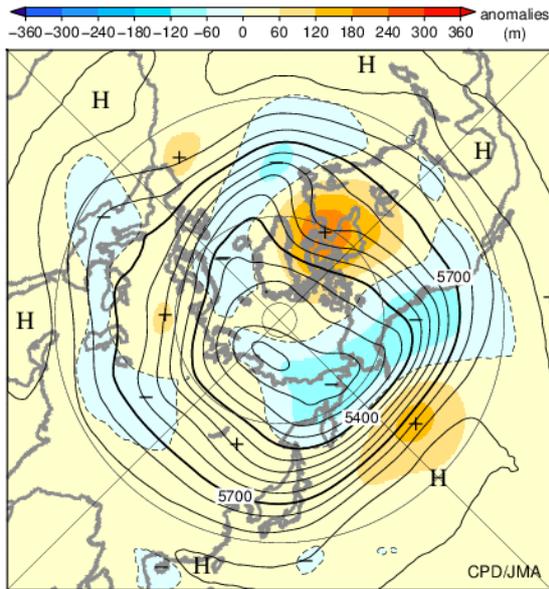


Fig. 9 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (October 2021)

The contours show 500-hPa height at intervals of 60 m. The shading indicates its anomalies. The base period for the normal is 1991-2020.

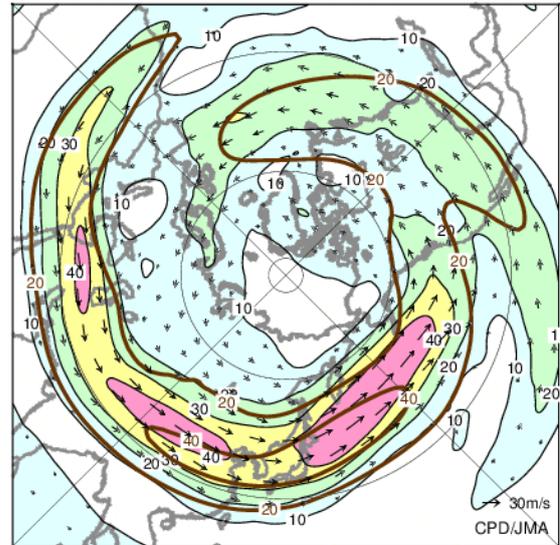


Fig. 10 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (October 2021)

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 1991-2020.

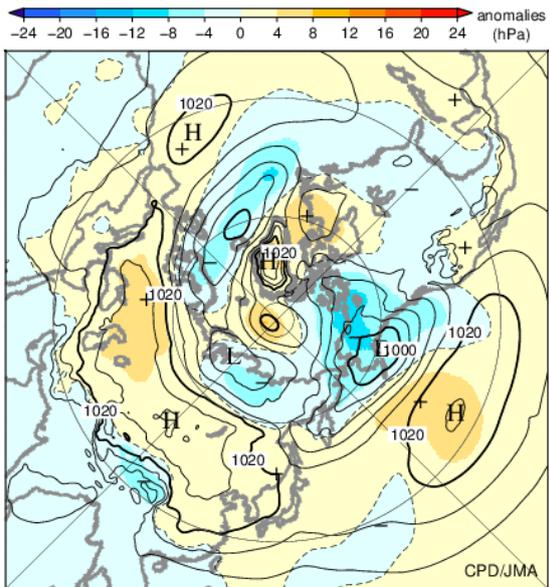


Fig. 11 Monthly mean sea level pressure and anomaly in the Northern Hemisphere (October 2021)

The contours show sea level pressure at intervals of 4 hPa. The shading indicates its anomalies. The base period for the normal is 1991-2020.

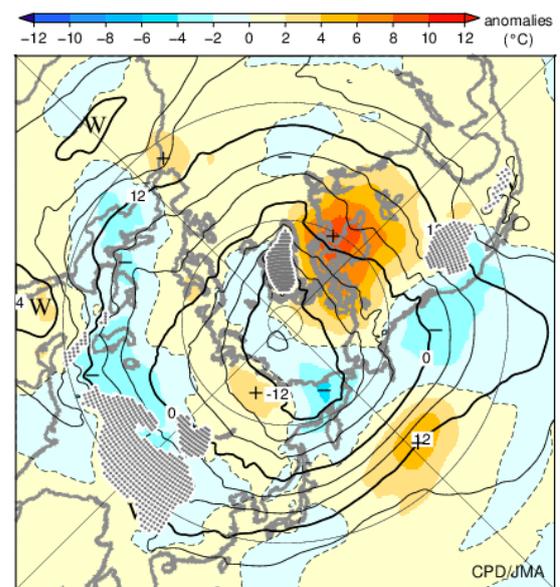


Fig. 12 Monthly mean 850-hPa temperature and anomaly in the Northern Hemisphere (October 2021)

The contours show 850-hPa temperature at intervals of 4 degree C. The shading indicates its anomalies. The base period for the normal is 1991-2020.

Detailed information on the climate system is available on the Tokyo Climate Center's website.

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

This report is prepared by the Tokyo Climate Center, Climate Prediction Division, Atmosphere and Ocean Department, Japan Meteorological Agency.