

Monthly Highlights on the Climate System (September 2021)

Highlights in September 2021

- Though ENSO-neutral conditions persisted (see [El Niño Outlook](#) updated on 11 October 2021) negative SST anomalies were observed from the central to eastern part of the equatorial Pacific.
- High pressure systems frequently covered northern Japan and that condition brought a record-breaking long sunshine duration to the Sea of Japan side of northern Japan.
- Monthly mean temperatures were extremely high from the northern Korean Peninsula to the northern part of Southeast Asia and in the central part of North America. Monthly precipitation amounts were extremely high in central China.
- Convective activity was enhanced from southwest of Sumatra to the Maritime Continent, and correspondingly easterly wind anomalies were dominant from the western to central equatorial Pacific in the lower troposphere.
- The subtropical jet stream shifted northward from its normal position over Eurasia.

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

Climate in Japan (Fig. 1):

- Northern Japan was frequently covered by high pressure systems. Monthly sunshine durations were significantly above normal on the Sea of Japan side of northern Japan (the longest on record for September since 1946) and above normal on the Pacific side of northern Japan. Monthly precipitation amounts were below normal in northern Japan.
- Monthly sunshine durations were below normal in western Japan and on the Pacific side of eastern Japan due to cloudy and rainy weather conditions brought by the fronts and Typhoon Chanthu until mid-September.
- In Okinawa/Amami, monthly mean temperatures and monthly sunshine durations were significantly above normal due to high pressure systems that often covered the region.

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 (4th warmest for September since 1891) (preliminary value) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.67°C per century in September (preliminary value).
- Extreme climate events were as follows (Fig. 3).
 - Monthly mean temperatures were extremely high in northern China, from the northern Korean Peninsula to the northern part of Southeast Asia, from the southern part of Central Asia to the northwestern part of South Asia, from the UK to Ireland, from southern Europe to the northern part of Northern Africa, in the western part of Western Africa, in the central part of North America, in the central part of South America, and from southern Argentina to South Georgia Island.
 - Monthly mean temperatures were extremely low from northern Borneo Island to Sulawesi Island, in and around Finland, and in eastern Europe.
 - Monthly precipitation amounts were extremely high from the east to south of the Lake Baikal, in central China, from Sulawesi Island to southern Sumatra Island, from central France to Spain, and from southeastern Canada to the northeastern USA.
 - Monthly precipitation amounts were extremely low in the northeast of the Lake Baikal and from southern Germany to Austria.

Oceanographic Conditions (Fig. 4):

- In the equatorial Pacific, remarkably positive SST anomalies were observed west of 150°E and negative SST anomalies were observed from the central to eastern part. The monthly mean SST deviation from the latest sliding 30-year mean over the NINO.3 region was -0.4°C (Fig. 5).

- In the North Pacific, remarkably positive SST anomalies were observed from the western tropical region to off the western coast of North America and from the area near the Kamchatka Peninsula to the area around the Aleutian Islands.
- 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 in the eastern part of the southern tropical Indian Ocean.
- In the North Atlantic, remarkably positive SST anomalies were observed off the eastern coast of North America. Remarkably positive SST anomalies were also observed in the equatorial Atlantic.

Tropics:

- Convective activity was enhanced from the northern Arabian Sea to the Bay of Bengal, from southwest of Sumatra to the Maritime Continent, and over the equatorial Atlantic, and suppressed from southern China to the seas northeast of the Philippines, around the date line in the tropical South Pacific, and from the eastern tropical North Pacific to the Caribbean Sea (Fig. 6).
- The active phase of equatorial intraseasonal oscillation was seen from the central Indian Ocean to the Maritime Continent, and the eastward propagation was unclear (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 from the western to central tropical Pacific (Fig. 8).
- In the lower troposphere, cyclonic circulation anomalies were seen from the Arabian Peninsula to India, and anti-cyclonic circulation anomalies straddling the equator were seen over the tropical Pacific, accompanying significantly anti-cyclonic circulation anomalies to the north of the Philippines. Easterly wind anomalies were dominant from the western to central equatorial Pacific.
- In the sea level pressure field, positive anomalies were seen from the central to eastern tropical Pacific, and negative anomalies were seen over the equatorial Atlantic and from the tropical Indian Ocean to the western equatorial Pacific, with significantly negative anomalies over the northern Arabian Sea. The Southern Oscillation Index value was +0.8 (Fig. 5).

Extratropics:

- In the 500-hPa height field (Fig. 9), wave trains were dominant from Europe to Central Asia and from the area near the Lake Baikal to the Chukchi Sea, with positive anomalies over Central Asia and to the northeast of the Lake Baikal. Another wave train was seen from northeastern China via the mid-latitude North Pacific to the western USA, with remarkably positive anomalies to the south of the Aleutian Islands and negative anomalies over the Gulf of Alaska.
- The subtropical jet stream shifted northward from its normal position over Eurasia. Over the mid-latitude North Pacific, the westerly jet stream was stronger than normal (Fig. 10).
- In the sea level pressure field (Fig. 11), positive anomalies were seen from the Eurasian side of the Arctic Ocean via Eastern Siberia to the Sea of Okhotsk, and negative anomalies were widely seen from Alaska to Canada. Significantly positive anomalies were seen over the mid-latitude central North Pacific.
- Temperatures at 850-hPa were above normal over central China and northwestern Northern Africa, and below normal from Western Russia to Western Siberia and from the East Siberian Sea to the Gulf of Alaska (Fig. 12).
- Zonal mean temperatures in the troposphere were remarkably above normal over the latitude band of 40°N and the mid-latitudes in the Southern Hemisphere. Zonal mean stratospheric temperatures in the Southern Hemisphere high-latitudes were below normal, with remarkable anomalies over the latitude bands from 50°S to 60°S in the lower stratosphere.

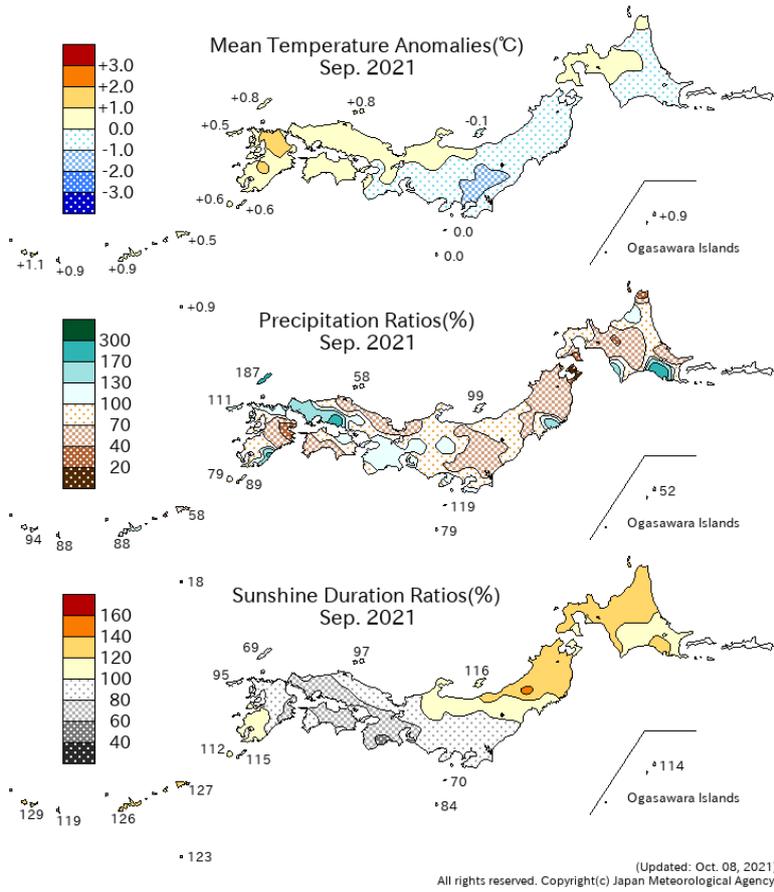


Fig. 1 Monthly climate anomaly/ratio over Japan (September 2021)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1991-2020.

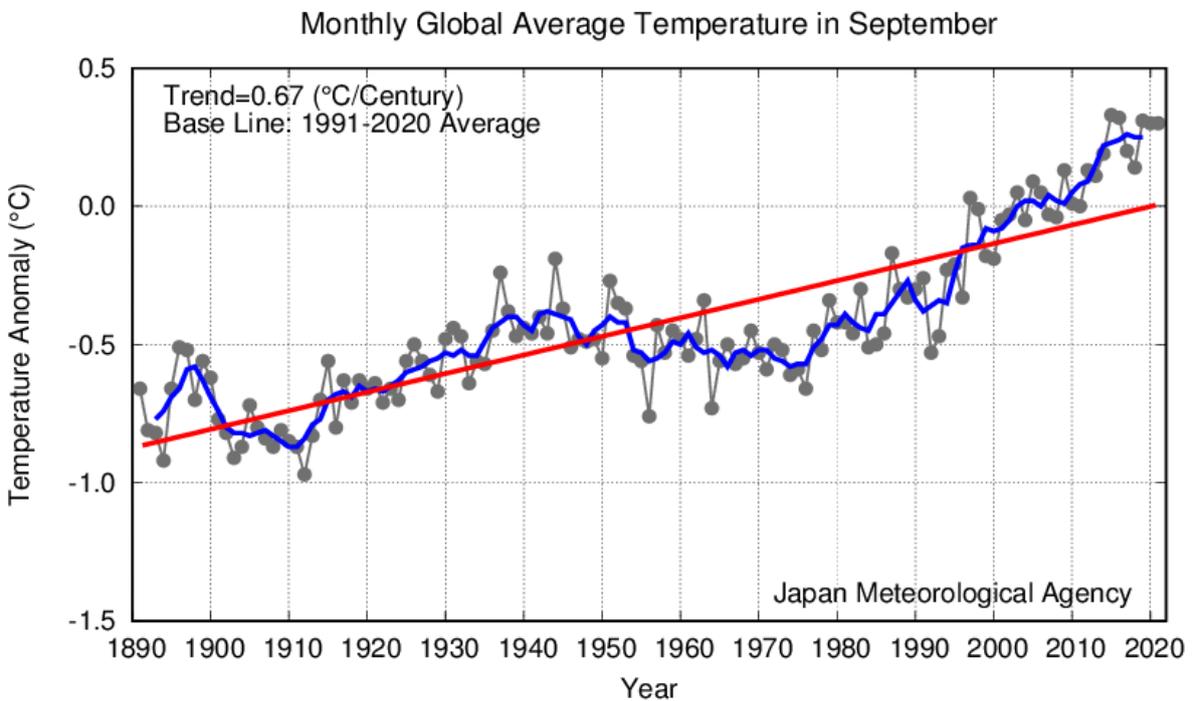


Fig. 2 Long-term change in monthly anomalies of global average surface temperature in September
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations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

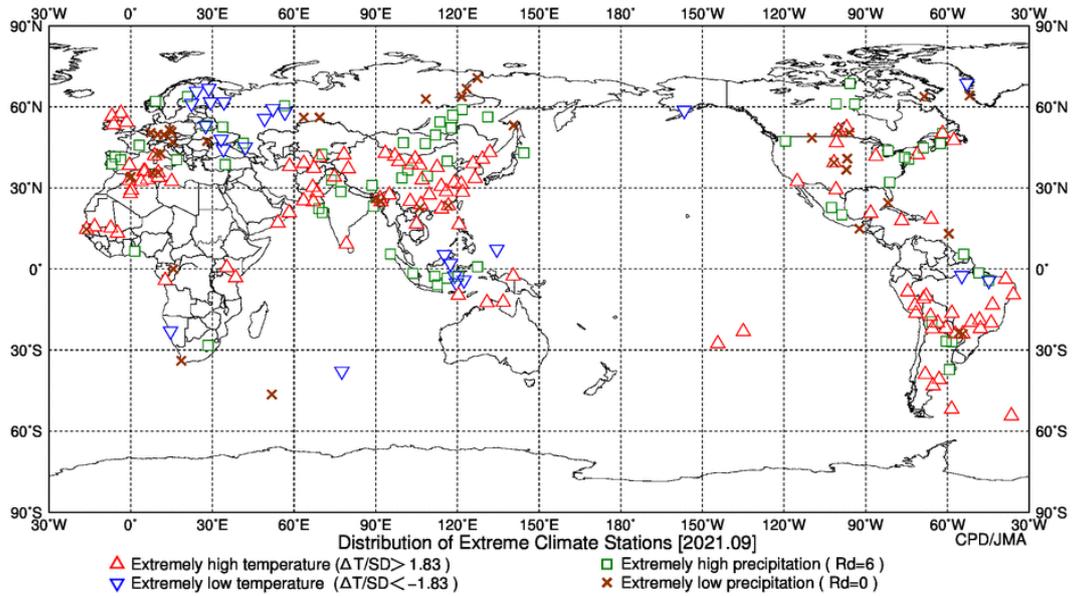


Fig. 3 Distribution of extreme climate stations (September 2021)

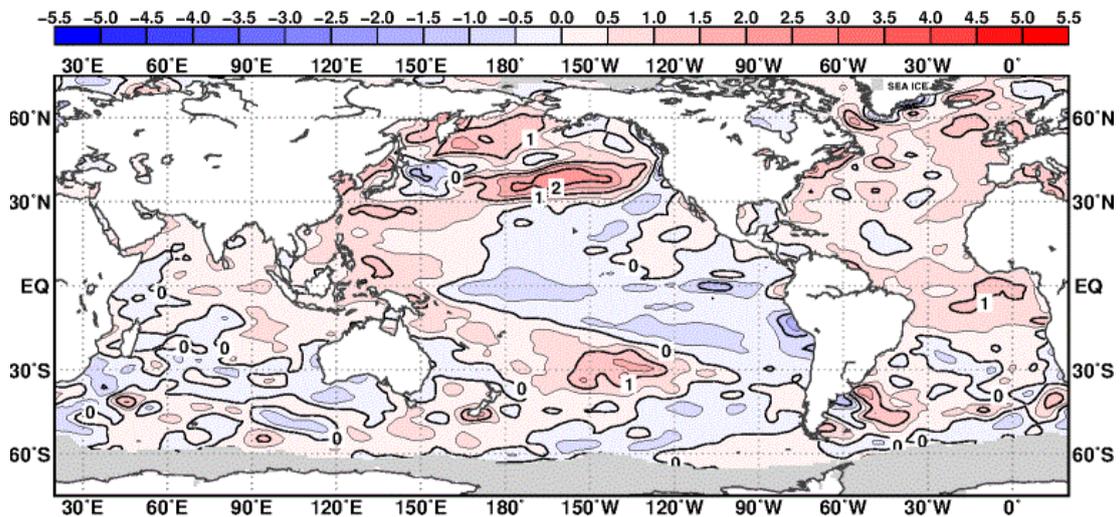


Fig. 4 Monthly mean sea surface temperature anomaly (September 2021)
 The contour interval is 0.5 degree C. The base period for the normal is 1991-2020. Maximum coverage with sea ice is shaded in gray.

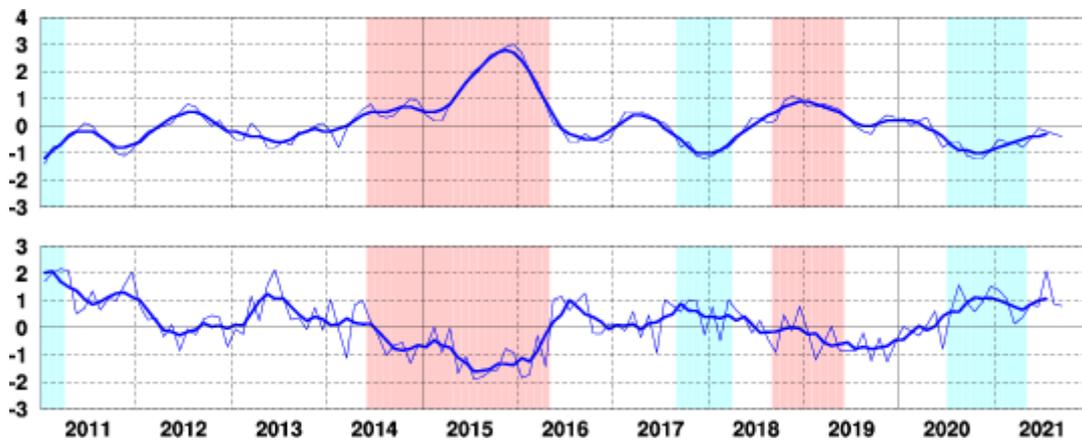


Fig. 5 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1991-2020 base period (lower). Thin blue lines represent monthly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

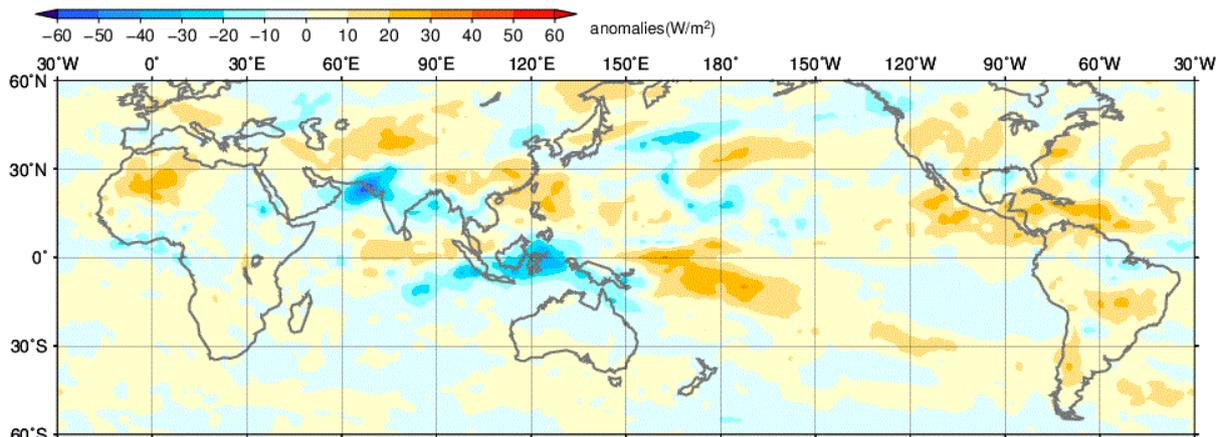


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (September 2021)
 The contour interval is 10 W/m². The base period for the normal is 1991-2020. Original data provided by NOAA.

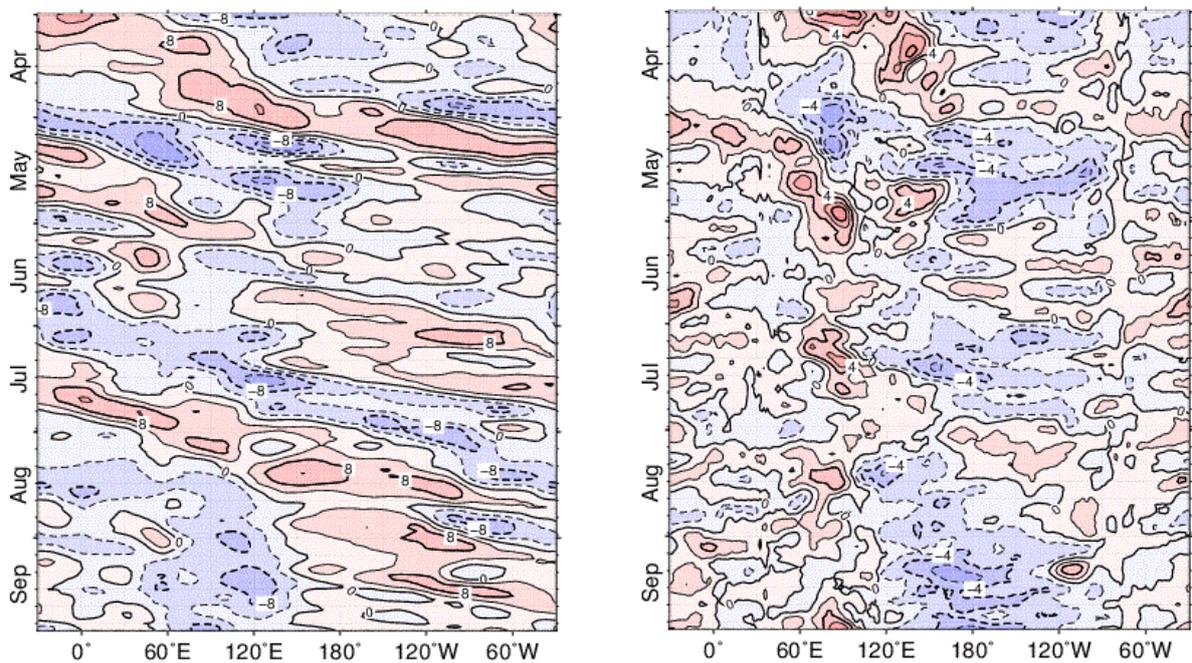


Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (April 2021 – September 2021)
 The contour intervals are 4×10^6 m²/s (left) and 2 m/s (right). The base period for the normal is 1991-2020.

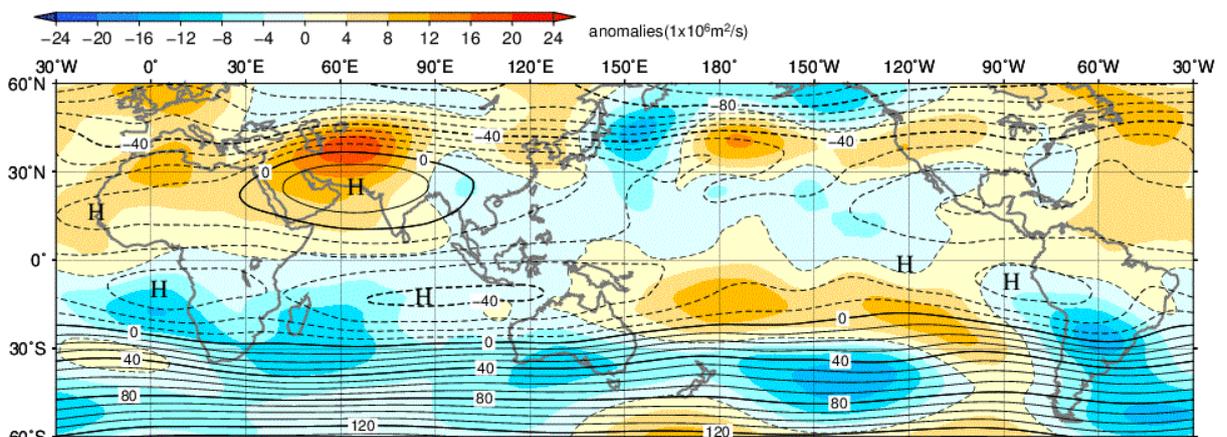


Fig. 8 Monthly mean 200-hPa stream function and anomaly (September 2021)
 The contour interval is 10×10^6 m²/s. The base period for the normal is 1991-2020.

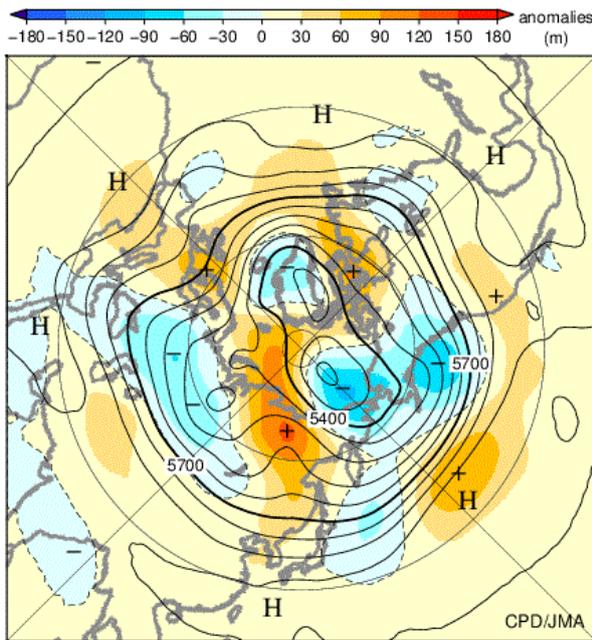


Fig. 9 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (September 2021)
The contours show 500-hPa height at intervals of 60 m. The shading indicates its anomalies. The base period for the normal is 1991-2020.

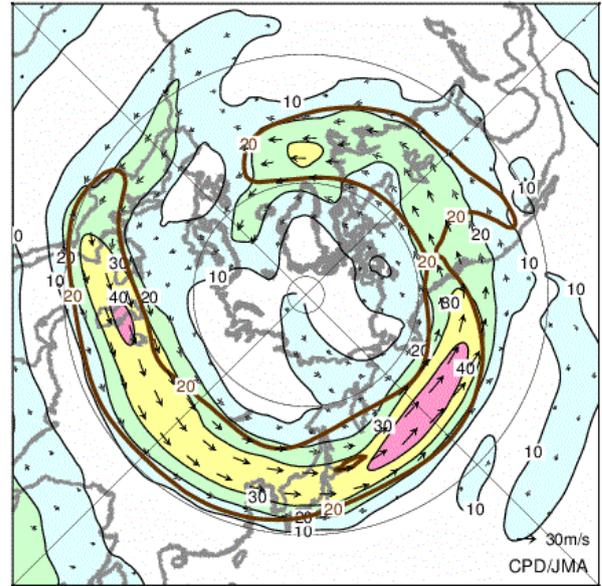


Fig. 10 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (September 2021)
The black lines show wind speed at intervals of 10 m/s. The brown lines show its normal at intervals of 20 m/s. The base period for the normal is 1991-2020.

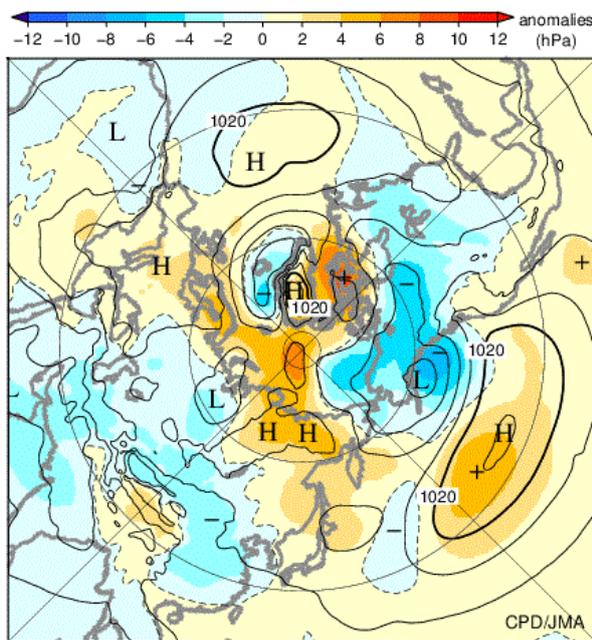


Fig. 11 Monthly mean sea level pressure and anomaly in the Northern Hemisphere (September 2021)
The contours show sea level pressure at intervals of 4 hPa. The shading indicates its anomalies. The base period for the normal is 1991-2020.

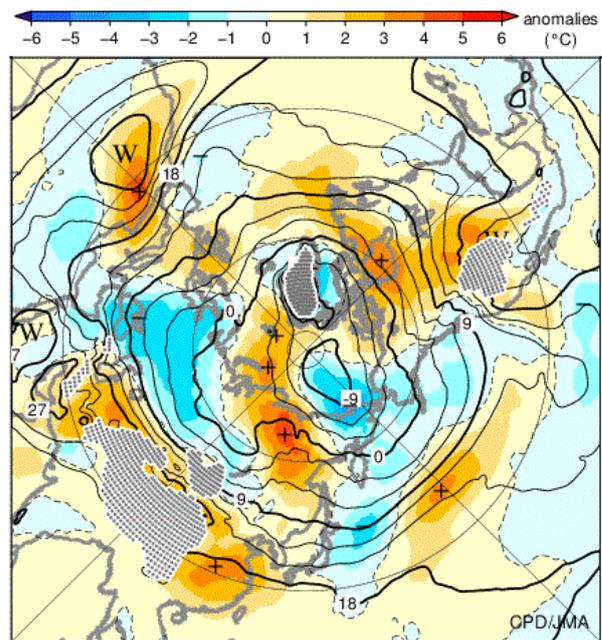


Fig. 12 Monthly mean 850-hPa temperature and anomaly in the Northern Hemisphere (September 2021)
The contours show 850-hPa temperature at intervals of 3 degree C. The shading indicates its anomalies. The base period for the normal is 1991-2020.

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.