# Monthly Highlights on the Climate System (February 2024)

Highlights in February 2024

- Oceanic indicators suggest that ongoing El Niño conditions in the equatorial Pacific have already peaked and are now gradually weakening (see El Niño Outlook updated on 11 March 2024).
- Monthly mean temperatures were significantly above normal in eastern/western Japan and Okinawa/Amami, and were above normal in northern Japan.
- Convective activity was enhanced over the tropical central Pacific and the western to central parts of the Indian Ocean, and suppressed from the eastern Indian Ocean to Indonesia, and from the tropical South America to the western Africa.
- In the 500-hPa height field, the polar vortex in the Northern Hemisphere split with positive anomalies from Western to Central Siberia and negative anomalies to the northwest of Europe and over the eastern part of Eastern Siberia. Wave trains were dominant over the Northern Hemisphere mid-latitudes with positive anomalies over northeastern North America, from northwestern Northern Africa to southern Europe, from Japan to the east, and negative anomalies to the west of the USA and over southern Western Siberia.
- The subtropical jet stream over Eurasia shifted southward from its normal position. The westerly jet stream shifted northward from Japan to the east, and southward from North America to the east, respectively, from its normal positions.

## Climate in Japan (Fig. 1):

- Monthly mean temperatures were significantly above normal in eastern/western Japan and Okinawa/Amami, and were above normal in northern Japan. Monthly snow fall amounts were significantly below normal on the Sea of Japan side of northern/eastern/western Japan. These anomalous climate conditions were caused by weaker-than-normal winter monsoon and warm-air inflow mainly in the middle of the month.
- Monthly precipitation amounts were significantly above normal on the Sea of Japan side and on the Pacific side in western Japan, and were above normal on the Pacific side of eastern Japan. Monthly sunshine durations were significantly below normal on the Sea of Japan side in western Japan and on the Pacific side in eastern/western Japan, because the regions were well affected by low-pressure systems and fronts in early and late part of the month.
- In Okinawa/Amami, monthly precipitation amounts were below normal and monthly sunshine durations were above normal in Okinawa/Amami, due to weaker influences of low-pressure systems and winter monsoon.

## 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 +0.66°C (the warmest for February since 1891) (preliminary value) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.83°C per century in February (preliminary value).
- Extreme climate events were as follows (Fig. 3).
  - Monthly mean temperatures were extremely high from Honshu region of Japan to the Korean Peninsula, from Southeast Asia to the southwestern Indian Ocean, from southeastern Europe to the eastern South Atlantic, in southeastern Canada, in northeastern South America, from central to southern South America, and in southwestern Australia.
  - Monthly precipitation amounts were extremely high from eastern Japan to southern Western Siberia, from eastern to western Europe, and in eastern Brazil.

## Oceanographic Conditions (Fig. 4):

- In the equatorial Pacific, remarkably positive SST anomalies were observed particularly from the central to

eastern parts. The monthly mean SST anomaly averaged over the NINO.3 region was +1.7˚C and the SST deviation from the latest sliding 30-year mean over the region was +1.8˚C.

- In the North Pacific, remarkably positive anomalies were observed from the western to central mid-latitudes.
- In the South Pacific, remarkably positive anomalies were observed from the central to eastern part of the tropics, while remarkably negative anomalies were observed from the central to eastern part of the subtropics.
- In the Indian Ocean, remarkably positive anomalies were observed in the tropics.
- In the North Atlantic, remarkably positive anomalies were observed from the tropical to the subtropical regions.

**Tropics:**

- Convective activity was enhanced over the tropical central Pacific and the western to central parts of the Indian Ocean, and suppressed from the eastern Indian Ocean to Indonesia, and from the tropical South America to the western Africa (Fig. 6).
- Eastward propagation of the active phase of equatorial intraseasonal oscillation was unclear (Fig. 7).
- In the upper troposphere, anti-cyclonic circulation anomalies straddling the equator were seen over the central to eastern Pacific. A wavy anomaly pattern was seen over the subtropical region in the Northern Hemisphere (Fig. 8).
- In the lower troposphere, cyclonic circulation anomalies straddling the equator were seen over the central Pacific, and anti-cyclonic circulation anomalies straddling the equator were also seen from the eastern Indian Ocean to the Maritime Continent.
- In the sea level pressure field along the equator, positive anomalies were seen over the tropical region, and negative anomalies were seen over the subtropical region of the central South Pacific. The Southern Oscillation Index value was -1.1 (Fig. 5).

**Extratropics:**

- In the 500-hPa height field (Fig. 9), the polar vortex in the Northern Hemisphere split with positive anomalies from Western to Central Siberia and negative anomalies to the northwest of Europe and over the eastern part of Eastern Siberia. Wave trains were dominant over the Northern Hemisphere mid-latitudes with positive anomalies over northeastern North America, from northwestern Northern Africa to southern Europe, from Japan to the east, and negative anomalies to the west of the USA and over southern Western Siberia.
- The subtropical jet stream over Eurasia shifted southward from its normal position. The westerly jet stream shifted northward from Japan to the east, and southward from North America to the east, respectively, from its normal positions (Fig. 10). The polar-front jet stream was clear from southern Siberia to the north of Japan.
- In the sea level pressure field (Fig. 11), positive anomalies were seen over a wide area from Central Siberia to the mid-latitude North Pacific through Japan, and negative anomalies were seen over a wide area from North America to western Europe. The Aleutian Low was generally weaker than normal except over its northern part.
- Temperatures at 850-hPa were above normal over North America, from the southern North Atlantic to southern Europe and over Japan, and negative anomalies to the southwest of the USA, over southern Western Siberia, and over Eastern Siberia (Fig. 12).
- In the zonal mean zonal wind, westerly wind anomalies were seen over the latitude bands of 20ºN and 50ºN in the tropospheric Northern Hemisphere. The polar night jet stream in the Northern Hemisphere stratosphere was weaker than normal. The zonal mean temperatures were above normal over the tropics and the mid-latitude in the troposphere and the high-latitude stratosphere in the Northern Hemisphere.
- In the 30-hPa height field, the polar vortex shifted toward western Eurasia and positive anomalies were seen over northern North America. The major stratospheric sudden warming occurred in the middle of February.

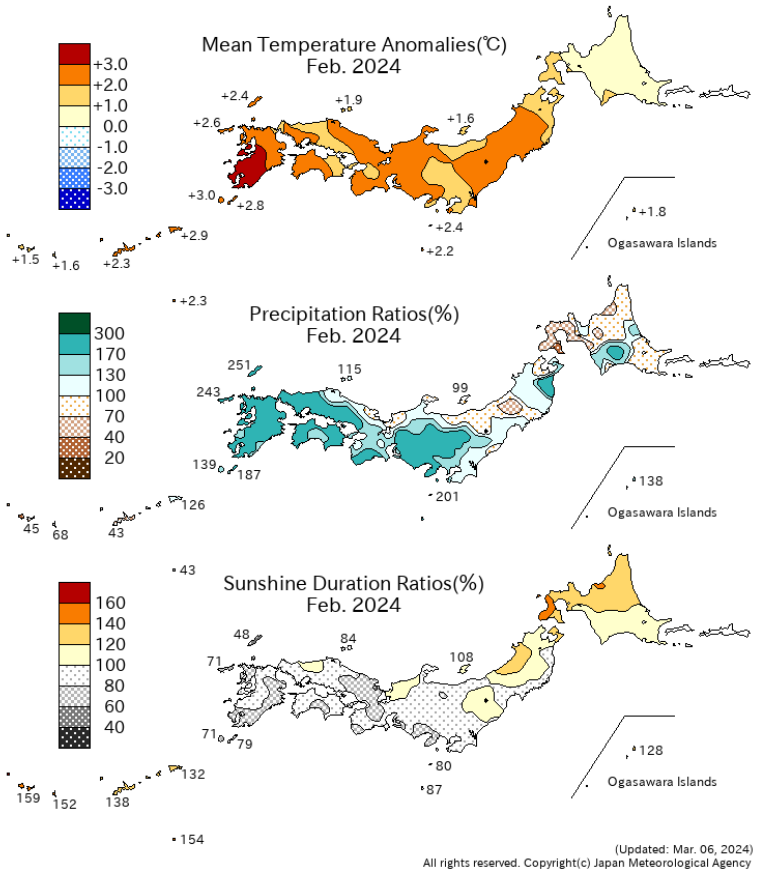


Fig. 1 Monthly climate anomaly/ratio over Japan (February 2024)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1991-2020.

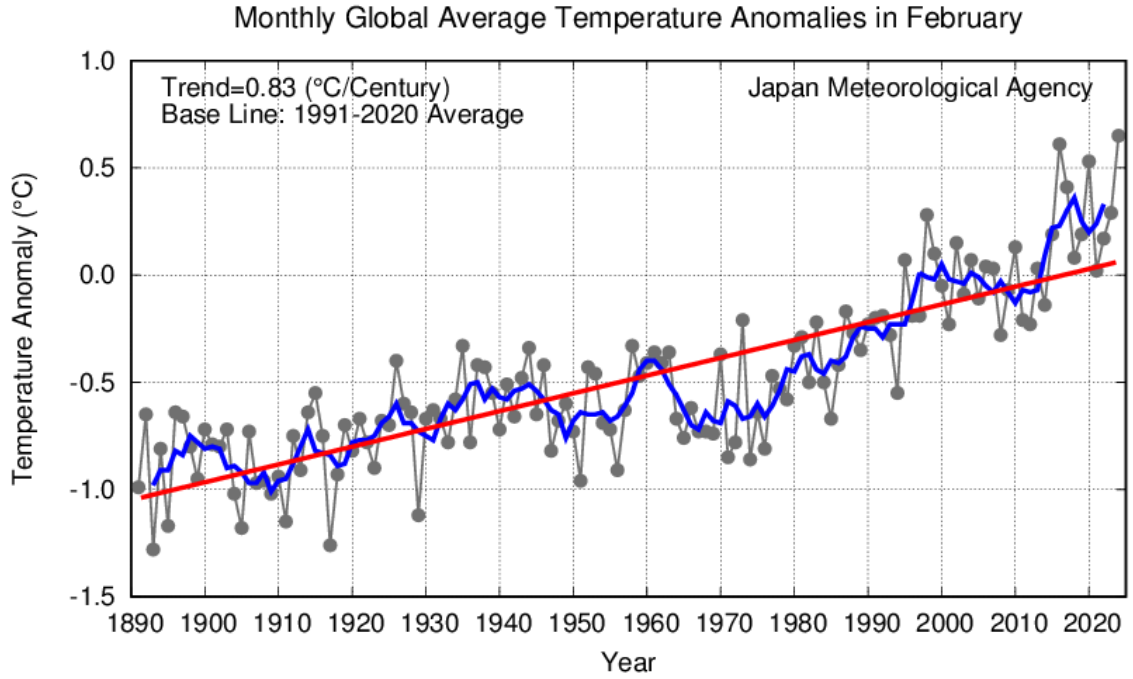


Fig. 2 Long-term change in monthly anomalies of global average surface temperature in February
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations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

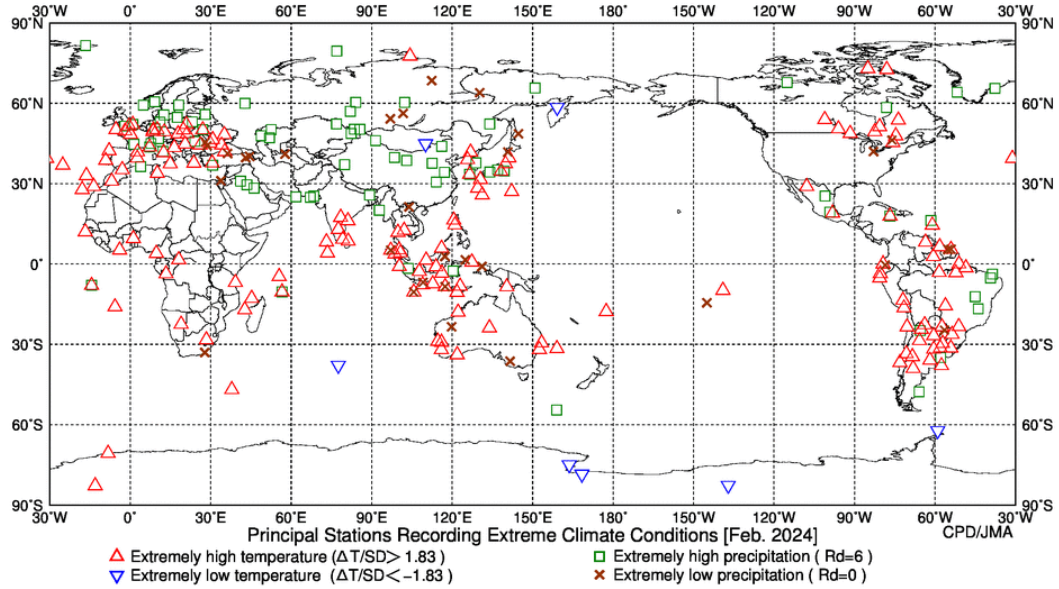


Fig. 3 Distribution of extreme climate stations (February 2024)

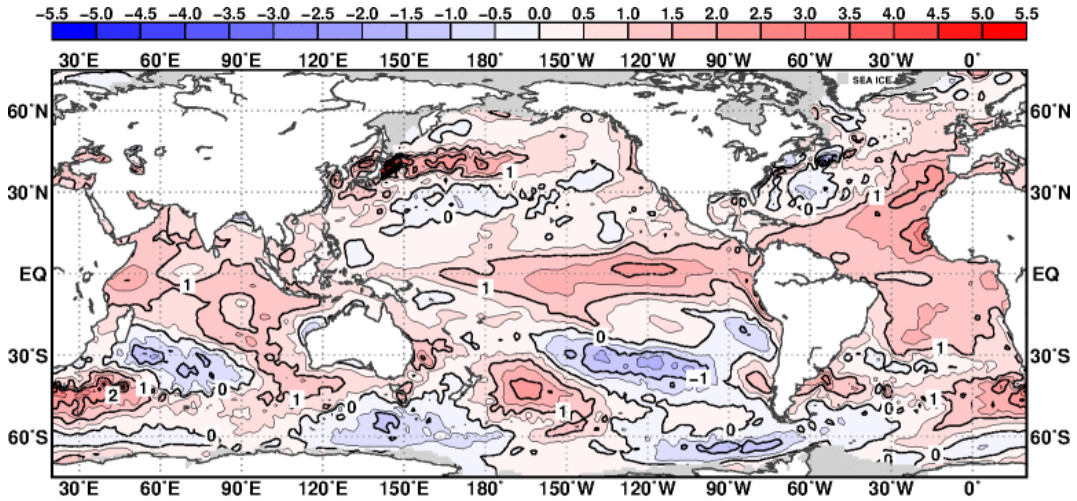


Fig. 4 Monthly mean sea surface temperature anomaly (February 2024)
The contour interval is 0.5 degree C. The base period for the normal is 1991-2020. Maximum coverage with sea ice is shaded in gray.

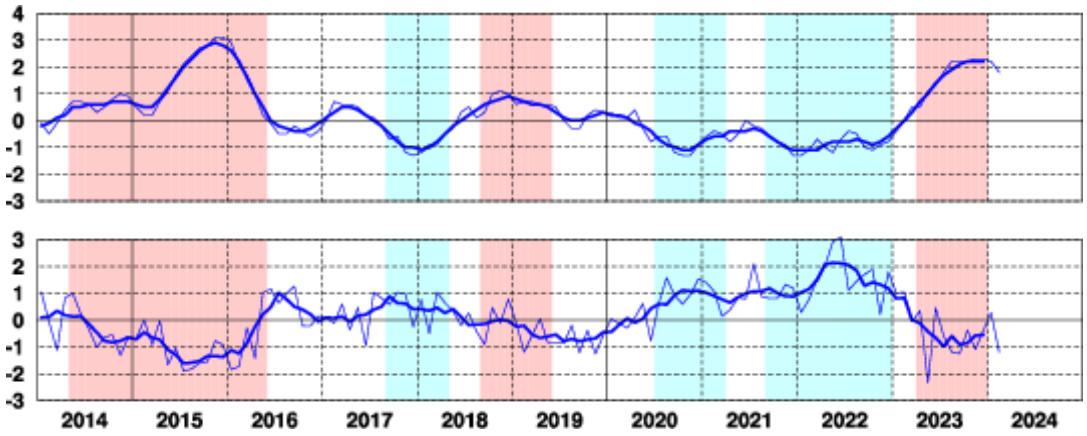

Fig. 5 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1991-2020 base period (lower).
Thin blue lines represent monthly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

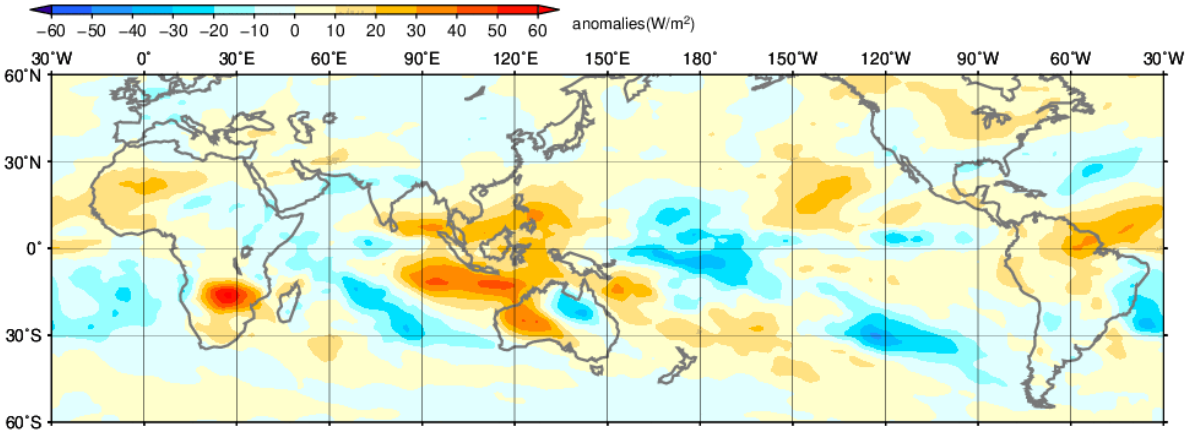


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (February 2024)
The shading interval is 10 W/m$^2$. The base period for the normal is 1991-2020. Original data (CPC Blended OLR) are provided by NOAA.

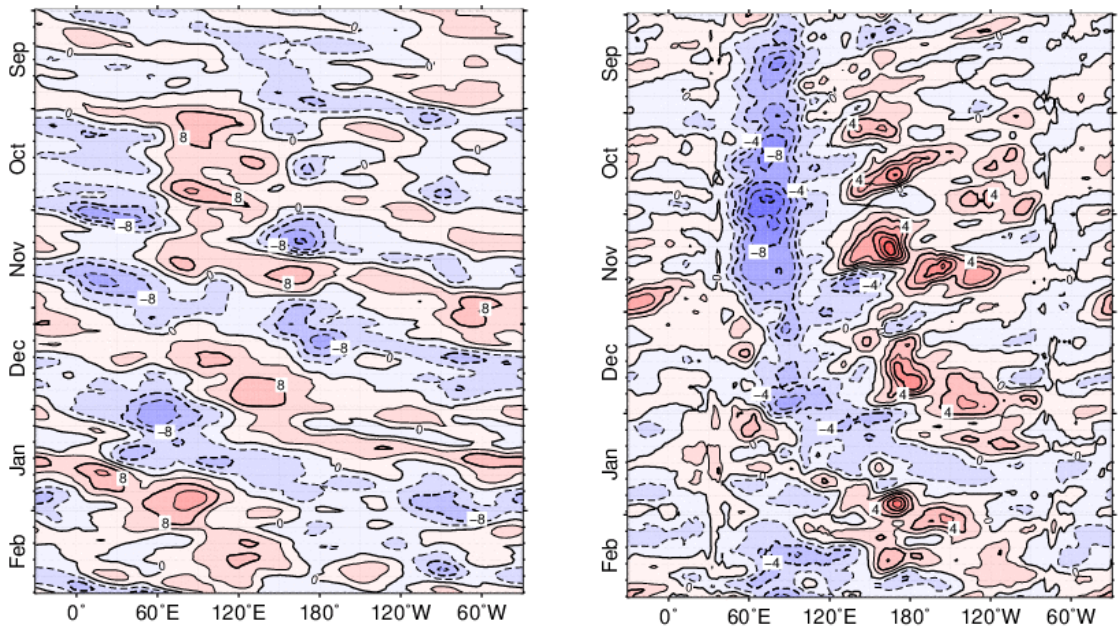


Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (September 2023 – February 2024)
The contour intervals are 4x10$^6$ m$^2$/s (left) and 2 m/s (right). The base period for the normal is 1991-2020.

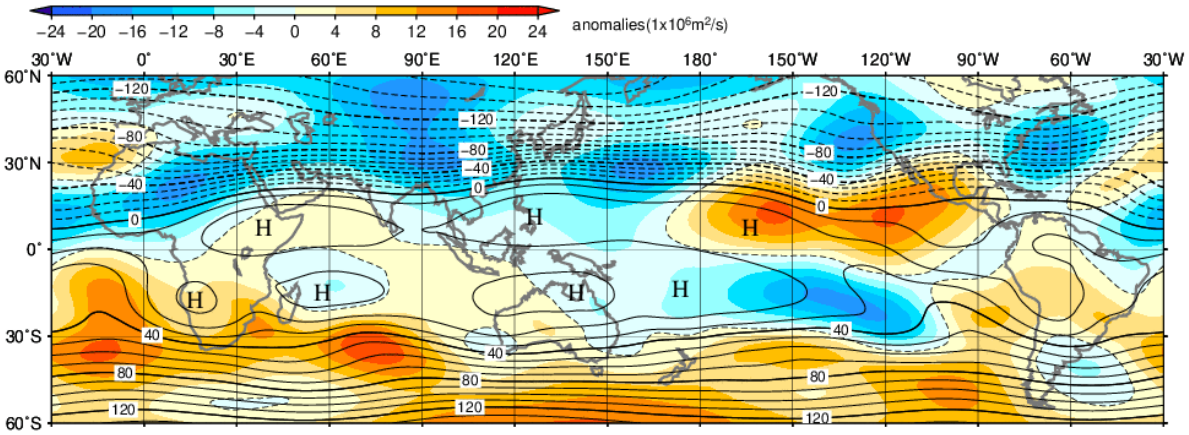


Fig. 8 Monthly mean 200-hPa stream function and anomaly (February 2024)
The contour interval is 10x10$^6$ m$^2$/s. The base period for the normal is 1991-2020.

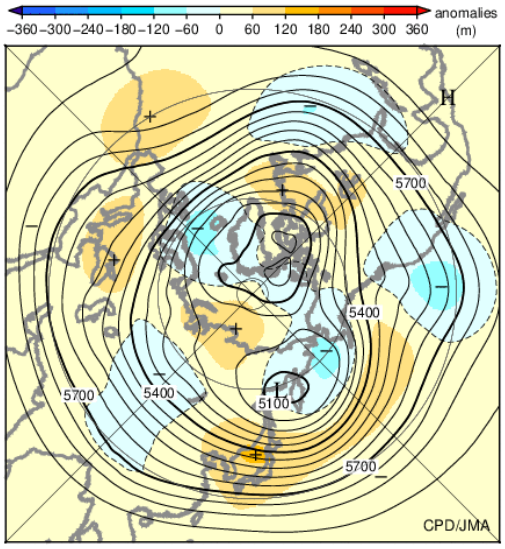


Fig. 9 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (February 2024)

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.

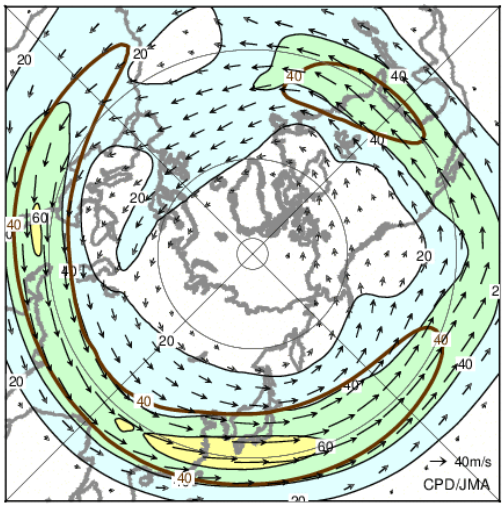


Fig. 10 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (February 2024)

The black lines show wind speed at intervals of 20 m/s. The brown lines show its normal at intervals of 40 m/s. The base period for the normal is 1991-2020.

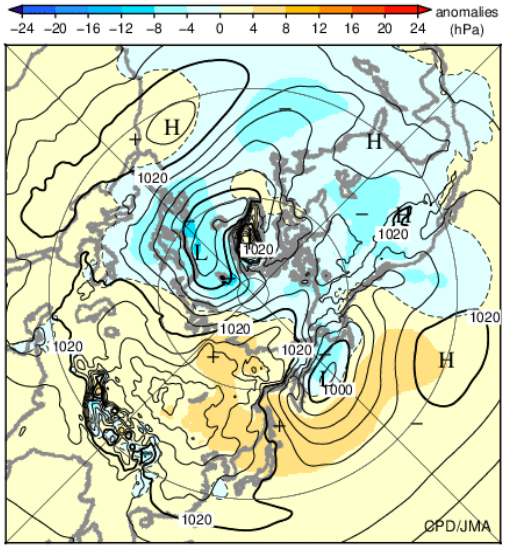


Fig. 11 Monthly mean sea level pressure and anomaly in the Northern Hemisphere (February 2024)

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.

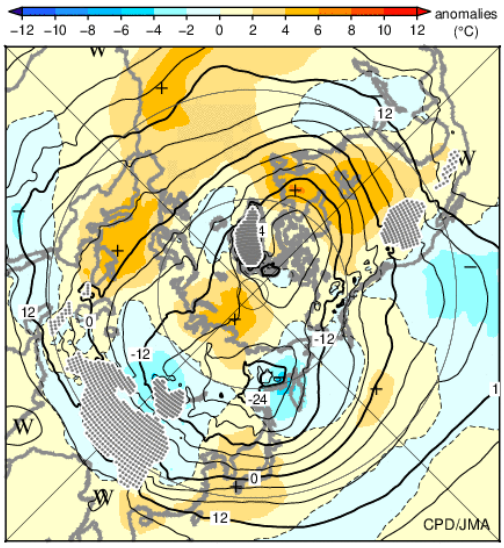


Fig. 12 Monthly mean 850-hPa temperature and anomaly in the Northern Hemisphere (February 2024)

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://www.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.