

Monthly Highlights on the Climate System (May 2021)

Highlights in May 2021

- The La Niña event that started in summer 2020 has terminated (see [El Niño Outlook](#) updated on 10 June 2021).
- Due to westward extension of the North Pacific Subtropical High and associated northward displacement of the Baiu-front, monthly mean temperature in Okinawa/Amami of Japan broke its highest record for May and monthly precipitation amounts were significantly above normal in western Japan.
- Monthly mean temperatures were extremely high in the region from the southern part of East Asia to the northern part of Southeast Asia and extremely low from central to northwestern Europe.
- In the equatorial Pacific, negative SST anomalies were observed in the central to eastern part.
- Convective activity was enhanced from the northwestern tropical Indian Ocean to northern India and over the latitude band of 5°N in the western Pacific, and suppressed from the Indochina Peninsula to the seas northeast of the Philippines and from the central tropical South Pacific to the Caribbean Sea.
- Corresponding to above-mentioned convective activity anomalies, the sea level pressure field showed that the North Pacific Subtropical High expanded westward over the seas south of Japan and negative anomalies were seen from northeastern China to Japan.

Notice: From this issue onward, the new climatological normal (1991-2020 average) is used unless otherwise stated.

Climate in Japan (Fig. 1):

- Monthly mean temperature in Okinawa/Amami was the highest on record for May since 1946, because the North Pacific Subtropical High extended westward of its climatological extent brought above normal solar radiation and southerly warm air advection.
- The Baiu-front was active and displaced northward of its climatological latitude in May. Due to this, in combination with low pressure systems, monthly precipitation amounts were significantly above normal in western Japan and monthly sunshine durations were significantly below normal in the Sea of Japan side of northern and eastern Japan.

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 +0.21°C (6th warmest for May since 1891) (preliminary value) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.72°C per century in May (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 northern part of Central Siberia, from the southern part of East Asia to the northern part of Southeast Asia, from southern China to eastern India, in and around Central Asia, and from the northwestern Middle East to the central part of Northern Africa.
 - Monthly mean temperatures were extremely low from the western part of Eastern Siberian to the southeastern part of Central Siberia, and from central to northwestern Europe.
 - Monthly precipitation amounts were extremely high from western Japan to eastern China, in the southwestern part of Central Siberia, from southwestern China to southwestern India, from Western Russia to northwestern Europe, and from the southern USA to central Mexico.
 - Monthly precipitation amounts were extremely low from the western part of Eastern Siberia to the southeastern part of Central Siberia, from the southwestern part of Western Siberia to the northwestern part of Central Asia, from the northwestern Middle East to southeastern Europe, from southeastern Canada to the Midwestern USA, and from central Bolivia to southeastern Paraguay.

Oceanographic Conditions (Fig. 4):

- In the equatorial Pacific, negative SST anomalies were observed in the central to eastern 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 -0.5°C (Fig. 5).
- In the North Pacific, remarkably positive SST anomalies were observed from east of Japan to the area off the western coast of North America.
- In the South Pacific, remarkably positive SST anomalies were observed east of New Zealand, and remarkably negative SST anomalies were observed in the central to eastern tropical region.
- In the Indian Ocean, remarkably positive SST anomalies were observed in the Arabian Sea and the Bay of Bengal.
- In the North Atlantic, remarkably positive SST anomalies were observed from the northern Caribbean Sea to the west of Gibraltar.

Tropics:

- Convective activity was enhanced from the northwestern tropical Indian Ocean to northern India and over the latitude band of 5°N in the western Pacific, and suppressed from the Indochina Peninsula to the seas northeast of the Philippines and from the central tropical South Pacific to the Caribbean Sea (Fig. 6).
- The active phase of equatorial intraseasonal oscillation propagated eastward from Africa to the western Pacific (Fig. 7).
- In the upper troposphere, anti-cyclonic circulation anomalies straddling the equator were seen from the western to central tropical Indian Ocean, and cyclonic circulation anomalies straddling the equator were seen over the central tropical Pacific (Fig. 8).
- In the lower troposphere, cyclonic circulation anomalies were seen over the Arabian Sea, and anti-cyclonic circulation anomalies were seen from the northern South China Sea to the latitude band of 30°N in the North Pacific and from the central to eastern tropical South Pacific.
- In the sea level pressure field, in the equatorial area, positive anomalies were seen from the eastern Pacific to the central Atlantic and over Africa, and negative anomalies were seen from the Indian Ocean to the central Pacific. The Southern Oscillation Index value was $+0.8$ (Fig. 5).

Extratropics:

- In the 500-hPa height field (Fig. 9), a wave train was clearly seen over northern Eurasia, with significantly positive anomalies over the Ural Mountains. Another wave train was observed from Europe to northeastern Africa, accompanying significantly positive anomalies over the eastern Mediterranean Sea.
- The subtropical jet stream from China to the seas east of Japan shifted northward from its normal position. The polar front jet stream over northern Eurasia exhibited significantly large meanders (Fig. 10).
- In the sea level pressure field (Fig. 11), the North Pacific Subtropical High expanded westward over the seas south of Japan and negative anomalies were seen from northeastern China to Japan. Significantly positive anomalies were seen off the western coast of North America and over the wide area of North America.
- Temperatures at 850-hPa were significantly above normal over the eastern Mediterranean Sea, over the Ural Mountains, and from southeastern China to the seas south of Japan, and below normal from Iceland to western Europe and over India (Fig. 12).
- Zonal mean temperatures in the troposphere were above normal over the latitude bands 30° to 40° N.

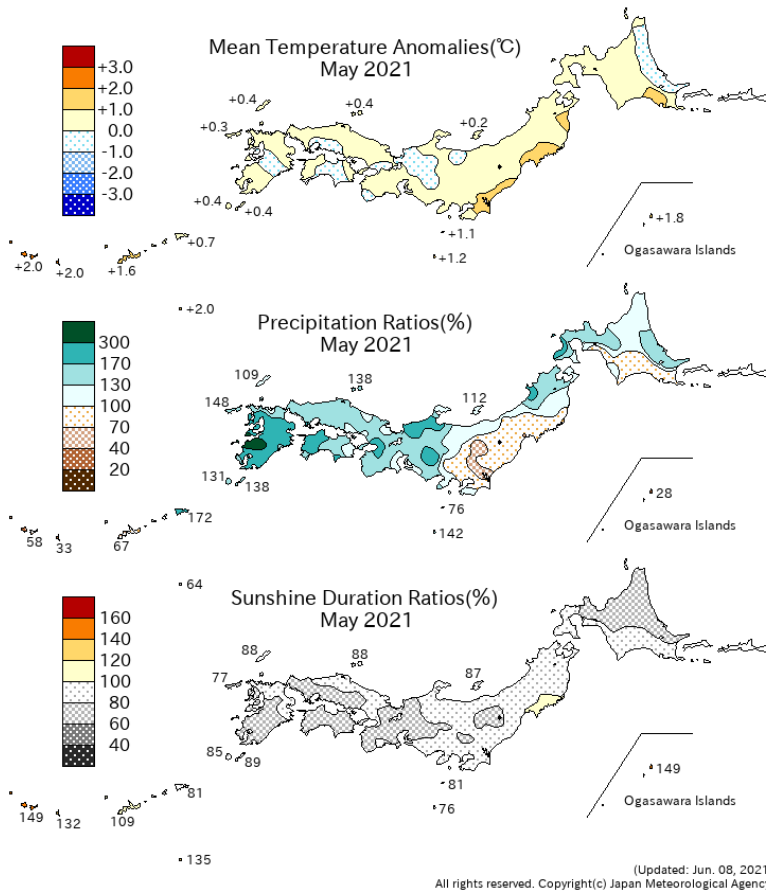


Fig. 1 Monthly climate anomaly/ratio over Japan (May 2021)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1991-2020.

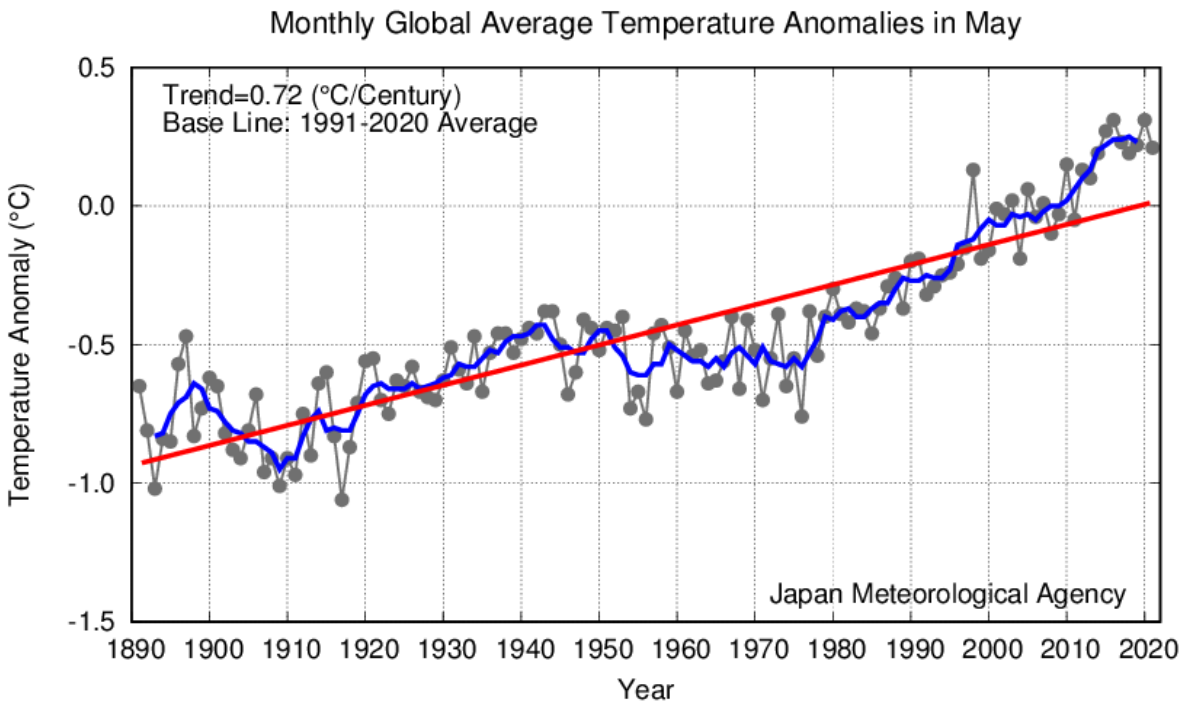


Fig. 2 Long-term change in monthly anomalies of global average surface temperature in May
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations from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

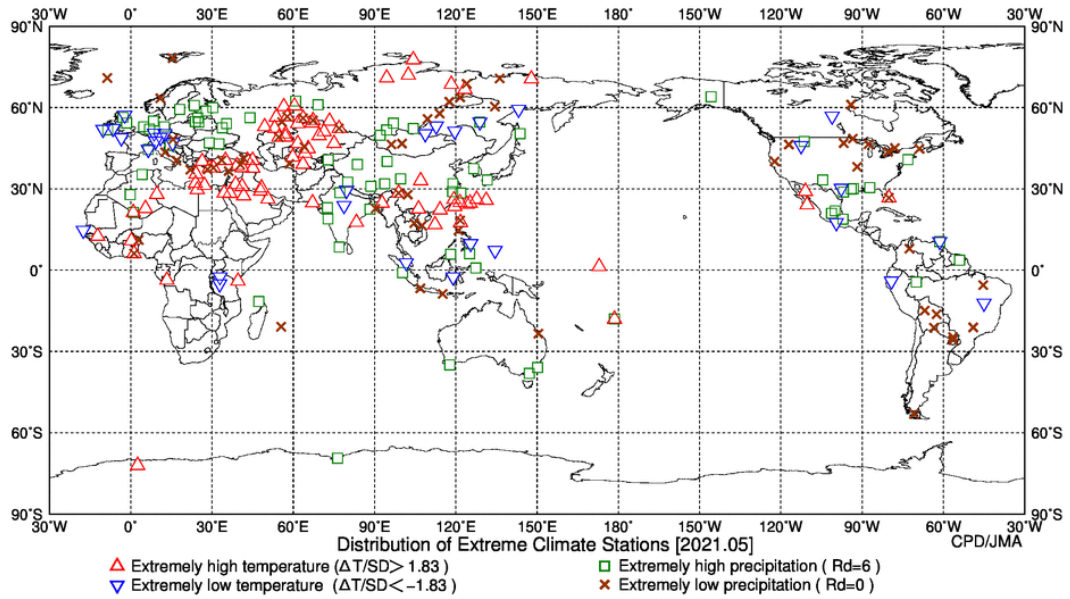


Fig. 3 Distribution of extreme climate stations (May 2021)

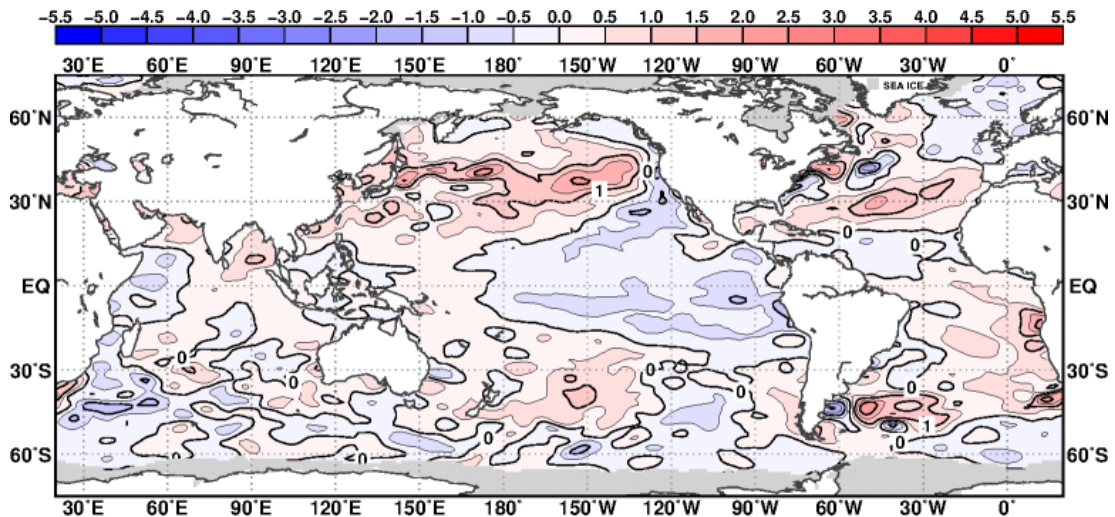


Fig. 4 Monthly mean sea surface temperature anomaly (May 2021)
 The contour interval is 0.5 degree C. The base period for the normal is 1991-2020. Maximum coverage with sea ice is shaded in gray.

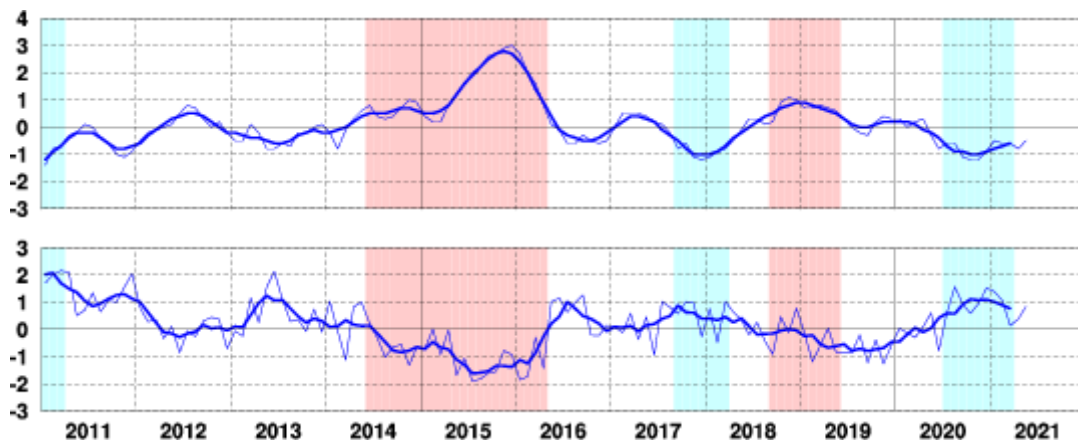


Fig. 5 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1991-2020 base period (lower). Thin blue lines represent monthly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

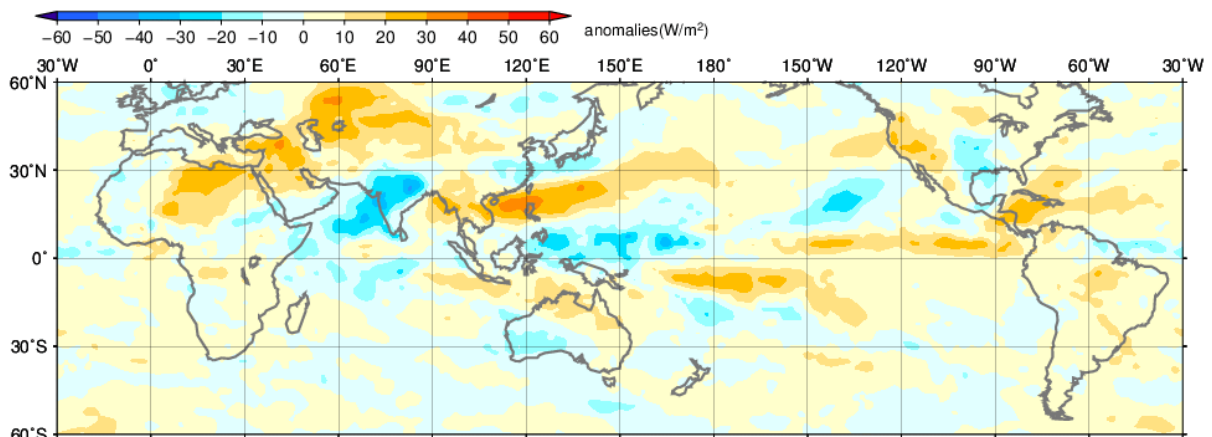


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (May 2021)
 The contour interval is 10 W/m². The base period for the normal is 1991-2020. Original data provided by NOAA.

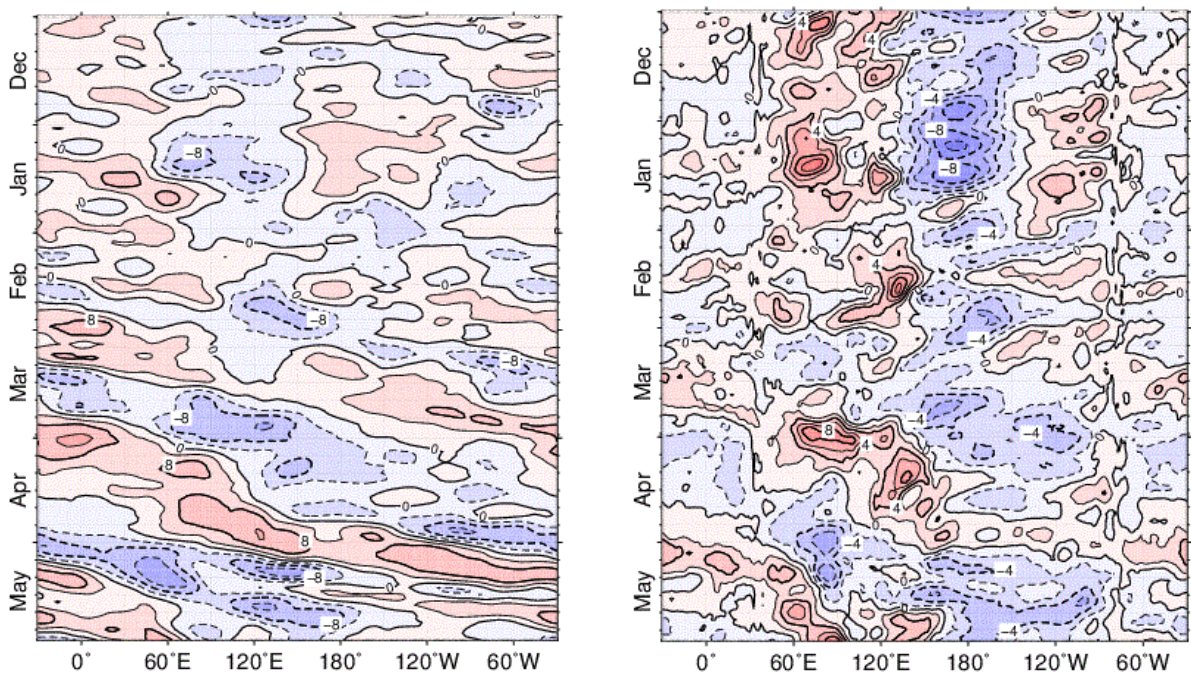


Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (December 2020 – May 2021)
 The contour intervals are 4×10^6 m²/s (left) and 2 m/s (right). The base period for the normal is 1991-2020.

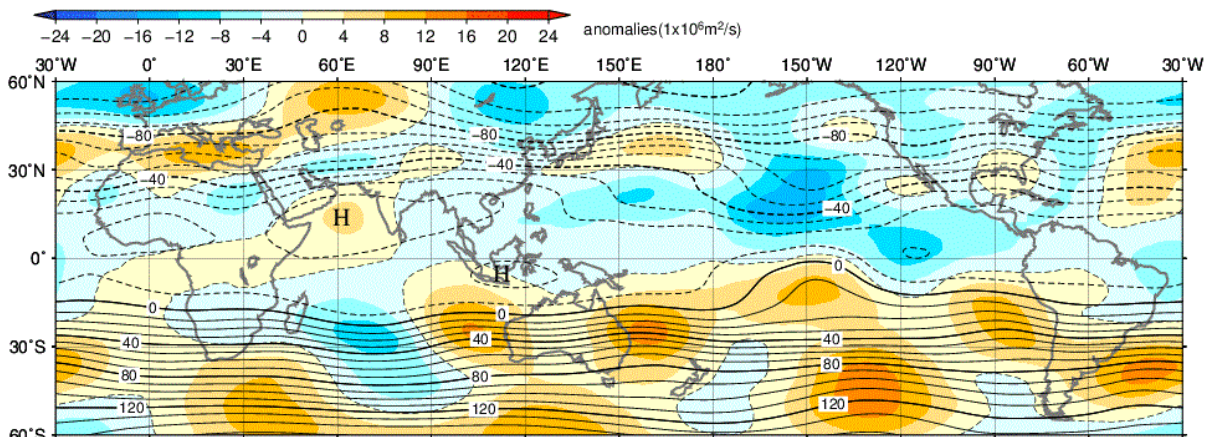


Fig. 8 Monthly mean 200-hPa stream function and anomaly (May 2021)
 The contour interval is 10×10^6 m²/s. The base period for the normal is 1991-2020.

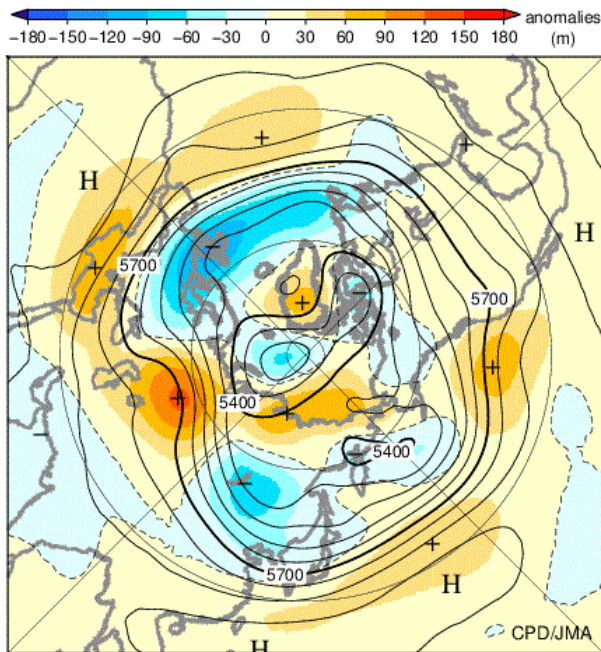


Fig. 9 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (May 2021)

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.

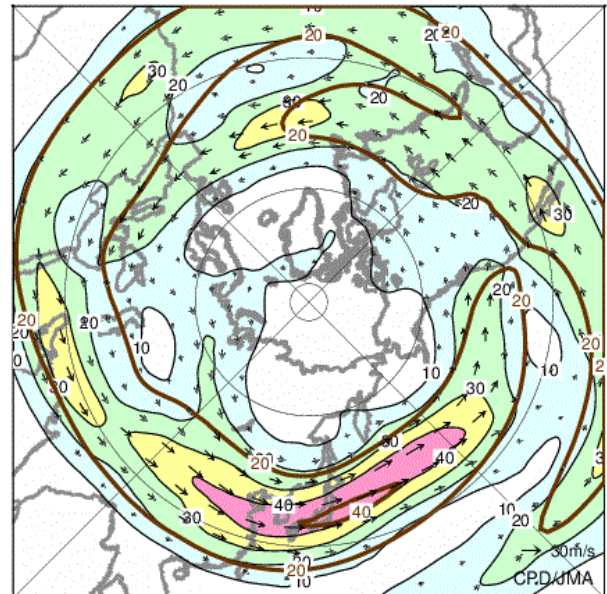


Fig. 10 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (May 2021)

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.

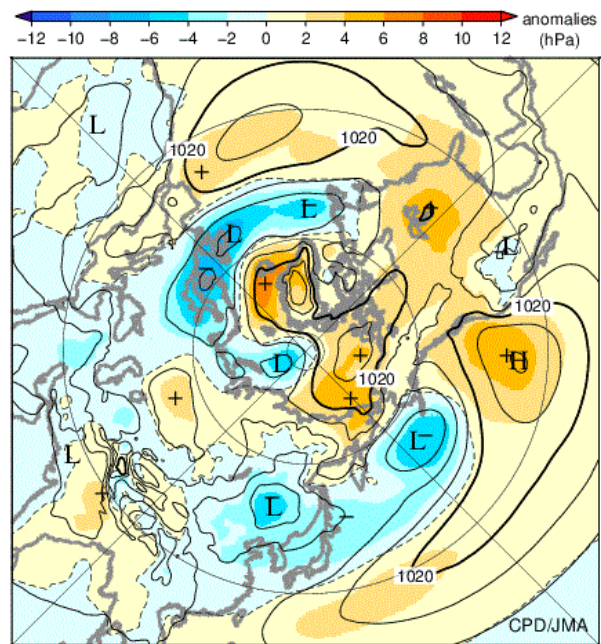


Fig. 11 Monthly mean sea level pressure and anomaly in the Northern Hemisphere (May 2021)

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.

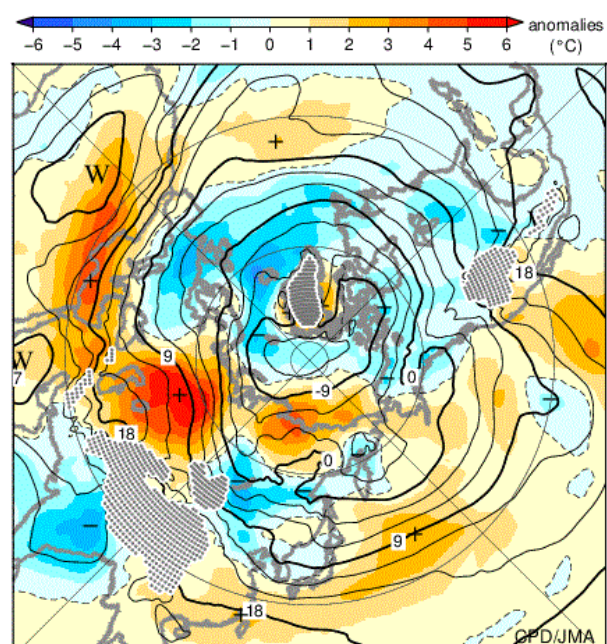


Fig. 12 Monthly mean 850-hPa temperature and anomaly in the Northern Hemisphere (May 2021)

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.