Monthly Highlights on the Climate System (October 2019)

Highlights in October 2019

- Monthly mean temperatures were significantly above normal from northern to western Japan.
- Monthly precipitation amounts were significantly above normal on the Pacific side of northern Japan and in eastern Japan.
- Monthly mean temperatures were extremely high from the southern part of Eastern Siberia to western Japan, from southwestern Russia to southern Europe, in the Arabian Peninsula, from Mauritius to South Africa, from the eastern USA to southern Mexico, and from southeastern to western Australia.
- In the equatorial Pacific, remarkably positive SST anomalies were observed in the western part.
- Convective activity was enhanced over the latitude band of 10°N in Africa and the northwestern Indian Ocean, and was suppressed from the northern part of the Bay of Bengal to the seas east of the Philippines, over the central to eastern part of the southern equatorial Indian Ocean, and over the tropical North Atlantic.
- In the 500-hPa height field, positive anomalies were seen over the seas southwest of the Kamchatka Peninsula and the seas south of Alaska, and from Greenland to eastern Canada, and negative anomalies were seen over the central part of North America and over northern Europe.
- The westerly jet stream shifted northward from its normal position over Japan.

Climate in Japan (Fig. 1):

- Monthly mean temperatures were significantly above normal from northern to western Japan because these regions tended to be covered with warm air.
- Monthly precipitation amounts were significantly above normal on the Pacific side of northern Japan and in eastern Japan. Heavy rainfalls were often observed from northern to western Japan due to low pressure systems, typhoons, fronts and moist air. Typhoon HAGIBIS (T1919), which made landfall on 12th October, brought record-breaking heavy precipitation from eastern to northern Japan, and caused floods over a large 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 +0.42°C (2nd 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 0.67°C per century in October (preliminary value).
- Extreme climate events were as follows (Fig. 3).
    - Monthly mean temperatures were extremely high from the southern part of Eastern Siberia to western Japan, from southwestern Russia to southern Europe, in the Arabian Peninsula, from Mauritius to South Africa, from the eastern USA to southern Mexico, and from southeastern to western Australia.
    - Monthly mean temperatures were extremely low from the northwestern to southern USA.
    - Monthly precipitation amounts were extremely high from the Pacific side of northern Japan to the Ogasawara Islands of Japan, in northwestern Europe, in the southern part of West Africa, and from the eastern to southeastern USA.
    - Monthly precipitation amounts were extremely low from the Indochina Peninsula to Java Island.

Oceanographic Conditions (Fig. 4):

- In the equatorial Pacific, remarkably positive SST anomalies were observed in the western part. In the NINO.3 region, the monthly mean SST anomaly and the SST deviation from the latest sliding 30-year mean were both +0.2°C (Fig. 5).

- In the North Pacific, remarkably positive SST anomalies were widely observed except the area near 20°N, 130°E, the area near 40°N, 170°E, and southwest of Mexico.
- In the South Pacific, remarkably positive SST anomalies were observed from east of New Guinea to the area near 50°S, 140°W, and remarkably negative SST anomalies were observed in the western coast of Chile and the area near 20°S, 110°W.
- In the Indian Ocean, remarkably positive SST anomalies were widely observed mainly in the western part except near the southwestern coast of Sumatra, where remarkably negative SST anomalies were observed.
- In the North Atlantic, remarkably positive SST anomalies were observed from the Gulf of Mexico to the area off the eastern coast of the Florida Peninsula and the equatorial area and the area near 35°N, 25°W, and remarkably negative SST anomalies were observed near 45°N, 45°W.

Tropics:

- Convective activity was enhanced over the latitude band of 10°N in Africa and the northwestern Indian Ocean, and was suppressed from the northern part of the Bay of Bengal to the seas east of the Philippines, over the central to eastern part of the southern equatorial Indian Ocean, and over the tropical North Atlantic (Fig. 6).
- The active phase of equatorial intraseasonal oscillation was seen from South America to Africa in early to mid-October, and propagated eastward from the Indian Ocean to the Maritime Continent in late October (Fig. 7).
- In the upper troposphere, cyclonic circulation anomalies were seen near the South China Sea and over the latitude band of 30°S in the central to eastern part of the southern Indian Ocean, and anti-cyclonic circulation anomalies were seen over northern Africa and over the wide area from the North Pacific to the North Atlantic, from the eastern part of South America to southern Africa, and around the tropical South Pacific (Fig. 8).
- In the lower troposphere, cyclonic circulation anomalies straddling the equator were seen over the eastern tropical Atlantic, and anti-cyclonic circulation anomalies straddling the equator were seen around the central to eastern Indian Ocean.
- In the sea level pressure field, in the equatorial area, positive anomalies were seen over the western Pacific, and negative anomalies were seen over the Atlantic and the Indian Ocean. The Southern Oscillation Index value was -0.4 (Fig. 5).

Extratropics:

- In the 500-hPa height field (Fig. 9), positive anomalies were seen over the seas southwest of the Kamchatka Peninsula and the seas south of Alaska, and from Greenland to eastern Canada, and negative anomalies were seen over the central part of North America and over northern Europe. A wave train was dominant from the North Pacific to the North Atlantic.
- The westerly jet stream shifted northward from its normal position over Japan, and was stronger than normal over North America and northern Europe (Fig. 10).
- In the sea level pressure field (Fig. 11), positive anomalies were seen over the southern part of the Kamchatka Peninsula, the seas south of Alaska, the northwestern USA and the east of Greenland, and negative anomalies were seen from the Chukchi Sea to the northwest of Greenland, and over northeastern Europe.
- Temperatures at 850-hPa were above normal over Japan, in and around Alaska, over the seas southwest of Greenland and the southeastern USA, and from southeastern Europe to the northern part of Central Asia, and below normal over the northwestern USA and northern Europe (Fig. 12).
- Zonal mean temperatures in the troposphere were generally above normal in the Northern Hemisphere.

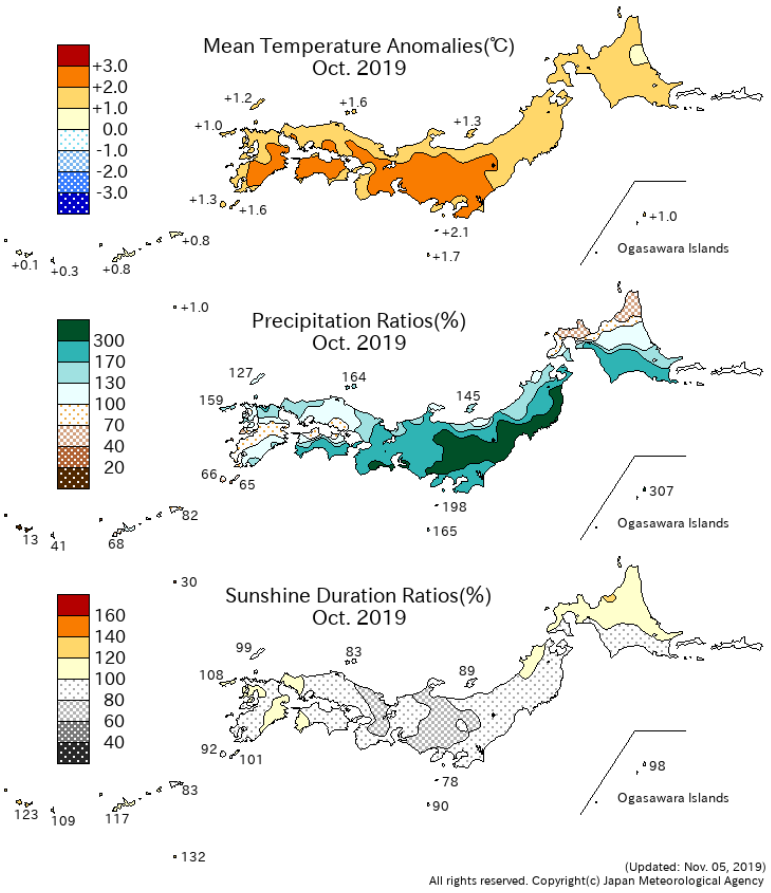

Fig. 1 Monthly climate anomaly/ratio over Japan (October 2019)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1981-2010.

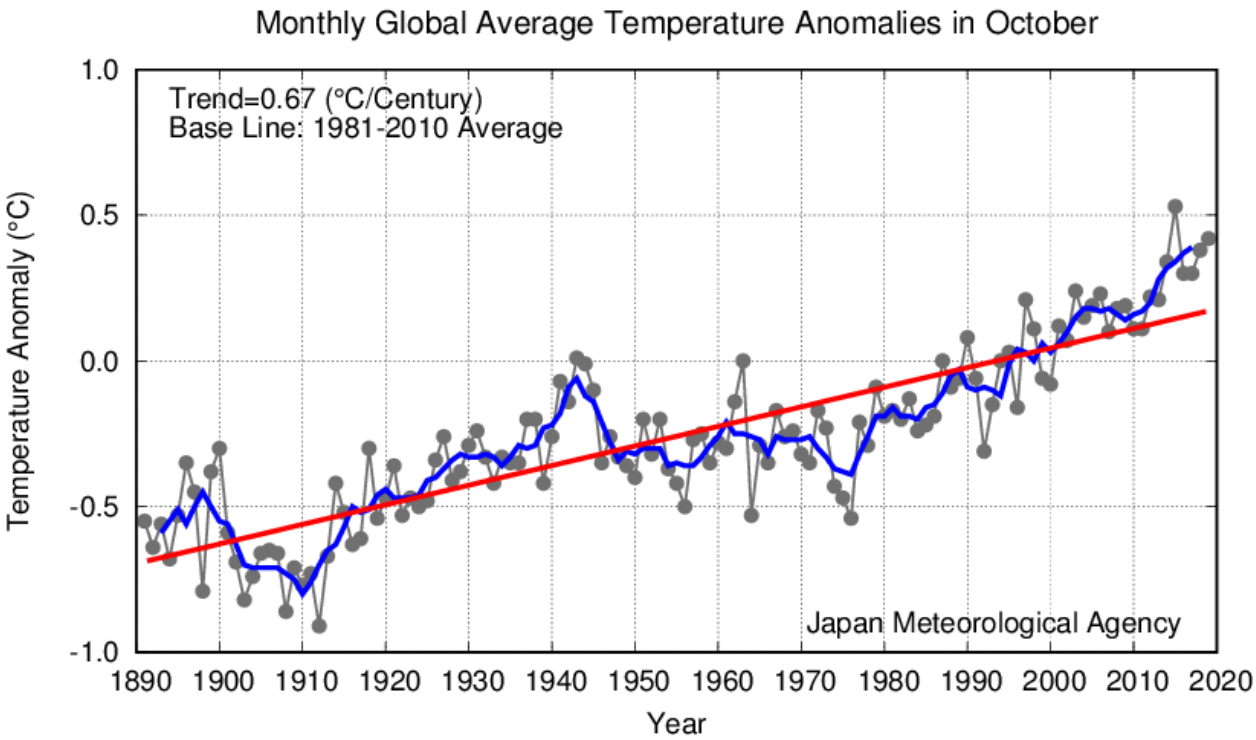

Fig. 2 Long-term change in monthly anomalies of global average surface temperature in October
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations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

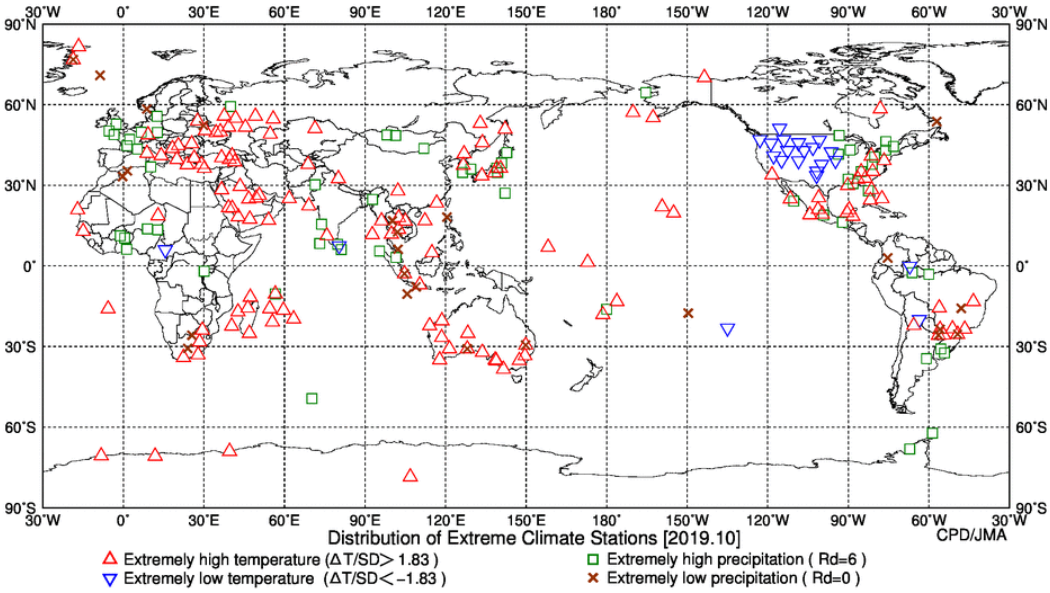

Fig. 3 Distribution of extreme climate stations (October 2019)

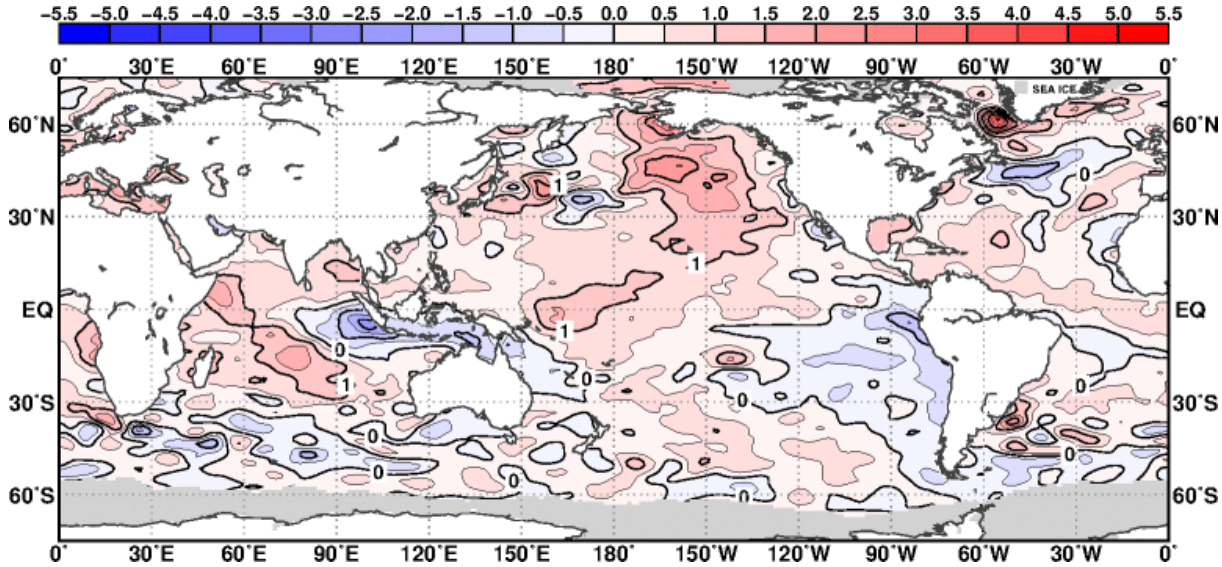

Fig. 4 Monthly mean sea surface temperature anomaly (October 2019)
The contour interval is 0.5 degree C. The base period for the normal is 1981-2010. Maximum coverage with sea ice is shaded in gray.

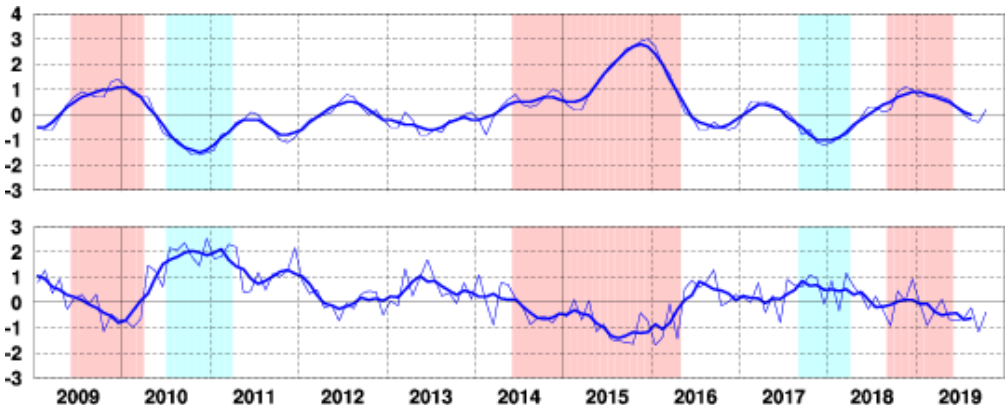

Fig. 5 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1981-2010 base period (lower).
Thin blue lines represent monthly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

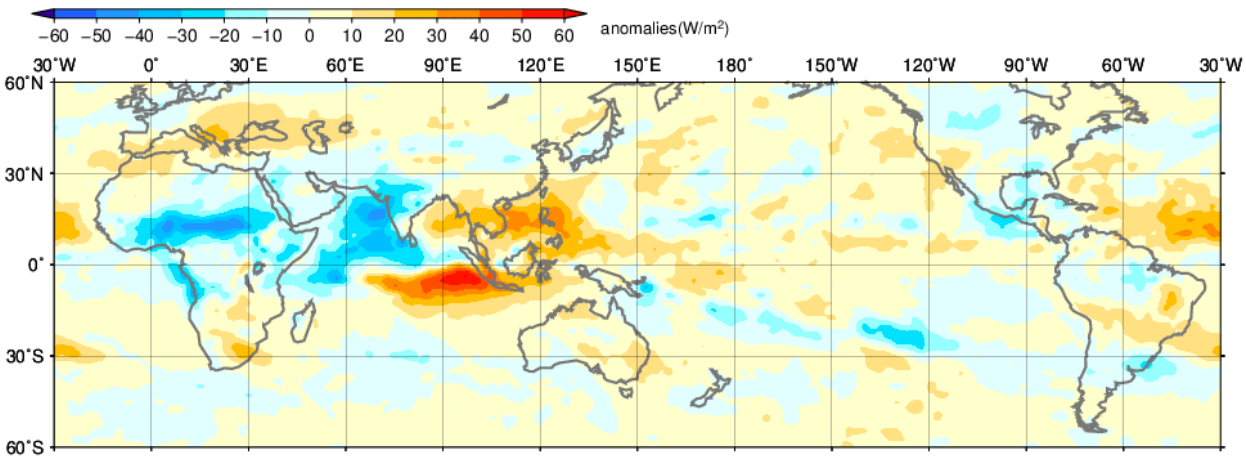

Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (October 2019)
The contour interval is 10 W/m^2. The base period for the normal is 1981-2010. Original data provided by NOAA.

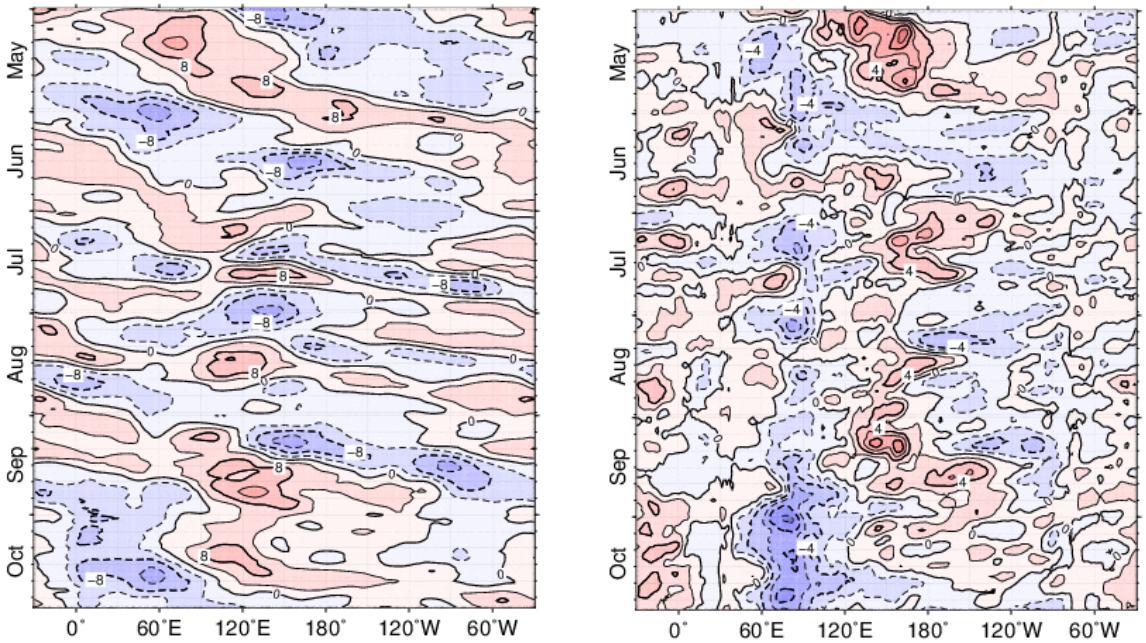

Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (May 2019 – October 2019)
The contour intervals are 4x10^6 m^2/s (left) and 2 m/s (right). The base period for the normal is 1981-2010.

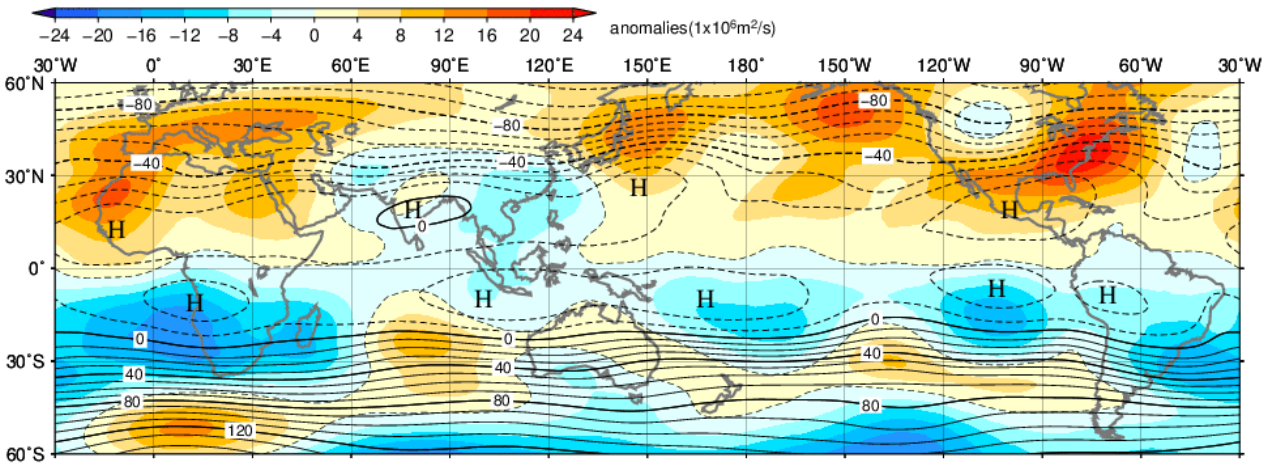

Fig. 8 Monthly mean 200-hPa stream function and anomaly (October 2019)
The contour interval is 10x10^6 m^2/s. The base period for the normal is 1981-2010.

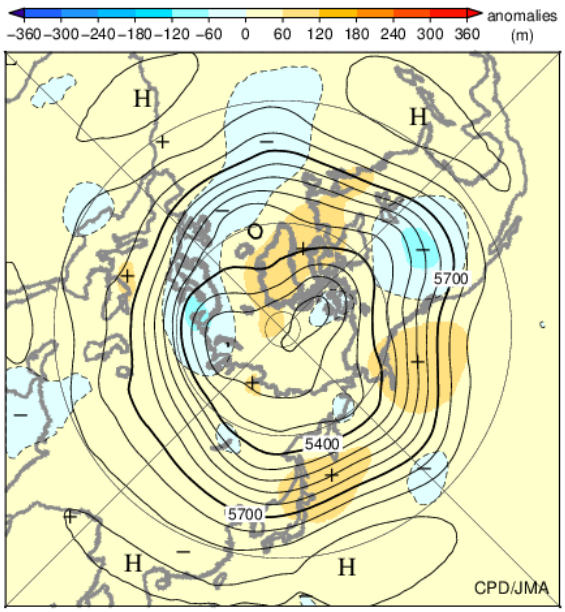

Fig. 9 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (October 2019)

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.

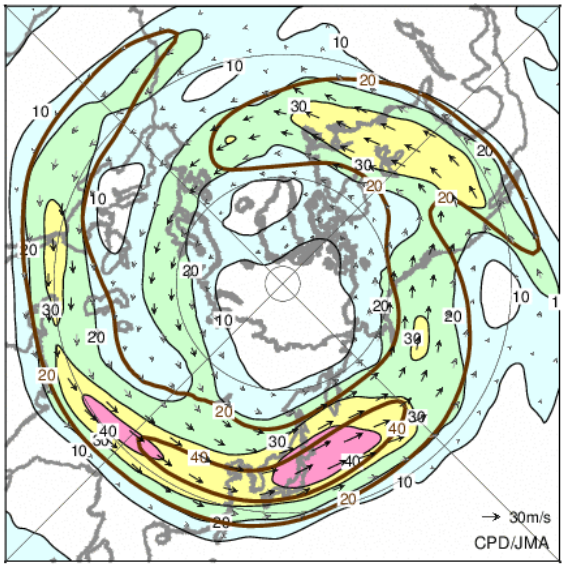

Fig. 10 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (October 2019)

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.

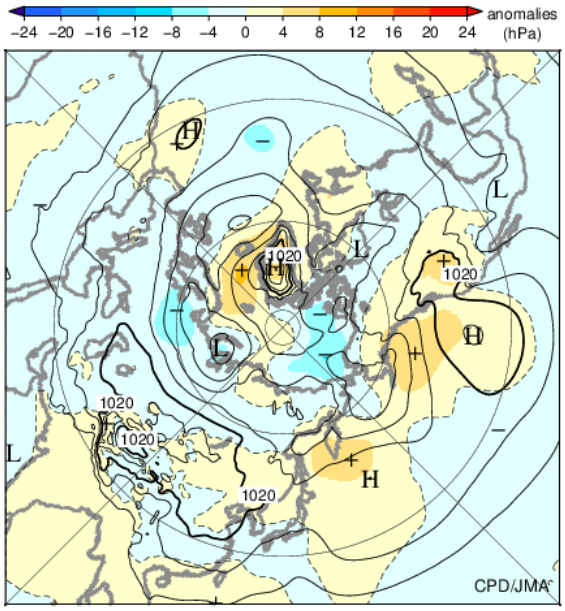

Fig. 11 Monthly mean sea level pressure and anomaly in the Northern Hemisphere (October 2019)

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.

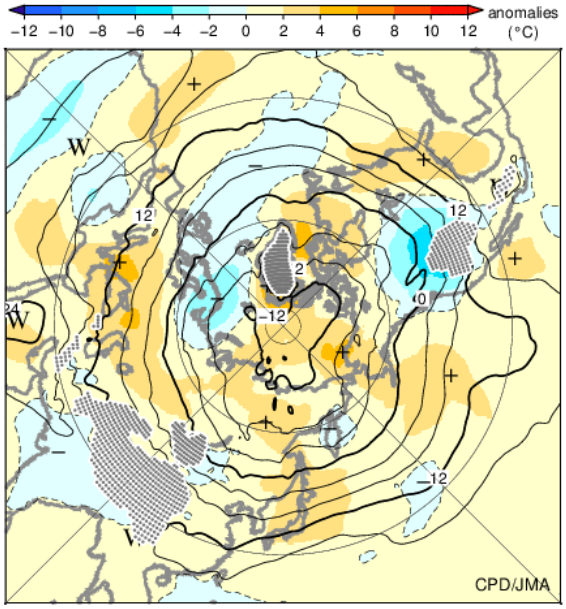

Fig. 12 Monthly mean 850-hPa temperature and anomaly in the Northern Hemisphere (October 2019)

The contours show 850-hPa temperature at intervals of 4 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.
https://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.