

Seasonal Highlights on the Climate System (December 2019 – February 2020)

Highlights (December 2019 – February 2020)

- The seasonal anomaly of the average temperature over Japan was the warmest for winter since 1897/1898.
- Seasonal mean temperatures were the highest on record for winter since 1946/1947 in eastern and western Japan. Seasonal snowfall amounts were the least on record for winter since 1961/1962 on the Sea of Japan side of northern and eastern Japan.
- Seasonal mean temperatures were extremely high from eastern Japan to central China, from Central Siberia to eastern Europe, from central to southwestern Europe, from the southeastern part of North America to the northwestern part of South America, and in Australia.
- In the equatorial Pacific, remarkably positive SST anomalies were observed in the western part.
- Convective activity was enhanced over the western tropical Indian Ocean, around the date line in the equatorial Pacific, and over the latitude band of 10°N in the central tropical North Pacific, and suppressed over the Maritime Continent.
- In the 500-hPa height field, positive anomalies were seen over Japan, the mid-latitudes in the central and eastern North Pacific, and southern Europe, and negative anomalies were seen over Alaska and near Iceland.
- The westerly jet stream shifted southward from its normal position from northern South Asia to southern China, and meandered northward over the mid-latitudes in the western North Pacific.

Climate in Japan (Fig. S1):

- The seasonal anomaly of the average temperature over Japan was +1.66°C (the warmest for the season since 1897/1898).
- Seasonal mean temperatures were the highest on record for winter since 1946/1947 in eastern and western Japan because winter monsoon and cold-air inflow were weaker than normal.
- Seasonal snowfall amounts were the least on record for winter since 1961/1962 on the Sea of Japan side of northern and eastern Japan.
- Seasonal precipitation amounts were significantly below normal on the Sea of Japan side of northern Japan, and were significantly above normal on the Sea of Japan side of western Japan.
- Seasonal sunshine durations were significantly below normal on the Pacific side of eastern Japan since cyclones periodically passed over mainland Japan, and were significantly above normal in Okinawa/Amami because of high pressure systems and weaker-than-normal cold-air inflow.

World Climate (Fig. S2):

- Seasonal mean temperatures were extremely high from eastern Japan to central China, from southwestern India to Sri Lanka, from Central Siberia to eastern Europe, from central to southwestern Europe, from the western to southern part of Western Africa, in and around northern Madagascar, from the southeastern part of North America to the northwestern part of South America, in eastern Brazil, from the Hawaiian Islands to the Marshall Islands, and in Australia.
- Seasonal mean temperatures were extremely low from central China to northern India.
- Seasonal precipitation amounts were extremely high from the western part of Eastern Siberia to the central part of Central Siberia, from the Korean Peninsula to the central part of Central Asia, from northwestern Russia to northeastern Europe, from central to western Europe, and in the southeastern USA.
- Seasonal precipitation amounts were extremely low from southern Europe to the northwestern part of Northern Africa, and from central Argentina to central Chile.

Oceanographic Conditions (Fig. S3):

- In the equatorial Pacific, remarkably positive SST anomalies were observed in the western part.
- In the North Pacific, remarkably positive SST anomalies were observed from east of the Philippines to far east of Japan, in the Gulf of Alaska, and in the central and eastern tropical regions.
- In the South Pacific, remarkably positive SST anomalies were observed east of New Guinea and east of New Zealand, and remarkably negative SST anomalies were observed from the western coast of Chile to the area near 15°S, 115°W.
- In the Indian Ocean, remarkably positive SST anomalies were observed in almost the entire tropical region.
- In the North Atlantic, remarkably positive SST anomalies were observed in the equatorial area and from the Gulf of Mexico to the Strait of Gibraltar.

Tropics:

- Convective activity was enhanced over the western tropical Indian Ocean, around the date line in the equatorial Pacific, and over the latitude band of 10°N in the central tropical North Pacific, and suppressed over the Maritime Continent (Fig. S4).
- In the upper troposphere, cyclonic circulation anomalies were seen over Northern Africa, southern China, around the date line and the eastern part in the tropical North Pacific, and over the western tropical North Atlantic, and anti-cyclonic circulation anomalies were seen over the Arabian Sea (Fig. S5).
- In the lower troposphere, cyclonic circulation anomalies straddling the equator were seen over the west of the date line in the tropical Pacific, and anti-cyclonic circulation anomalies straddling the equator were seen from central tropical Indian Ocean to the Maritime Continent.
- In the sea level pressure field, in the equatorial area, positive anomalies were seen over Africa, the Maritime Continent, and South America, and negative anomalies were seen over the western Indian Ocean and around the date line.

Extratropics:

- In the 500-hPa height field (Fig. S6), positive anomalies were seen over Japan, the mid-latitudes in the central and eastern North Pacific, and southern Europe, and negative anomalies were seen over Alaska and near Iceland. A wave train was seen from Greenland via the Mediterranean Sea to South Asia.
- The westerly jet stream was stronger than normal from the North Atlantic to northern Europe, shifted southward from its normal position from northern South Asia to southern China, and meandered northward over the mid-latitudes in the western North Pacific (Fig. S7).
- In the sea level pressure field (Fig. S8), the Aleutian Low and the Siberian High were weaker than normal. Negative anomalies were seen over a wide area of the northern polar region and northwestern Canada.
- Temperatures at 850-hPa were above normal over eastern North America, and from Europe via Central Siberia to Japan, and below normal over Alaska and the seas south of Greenland (Fig. S9).

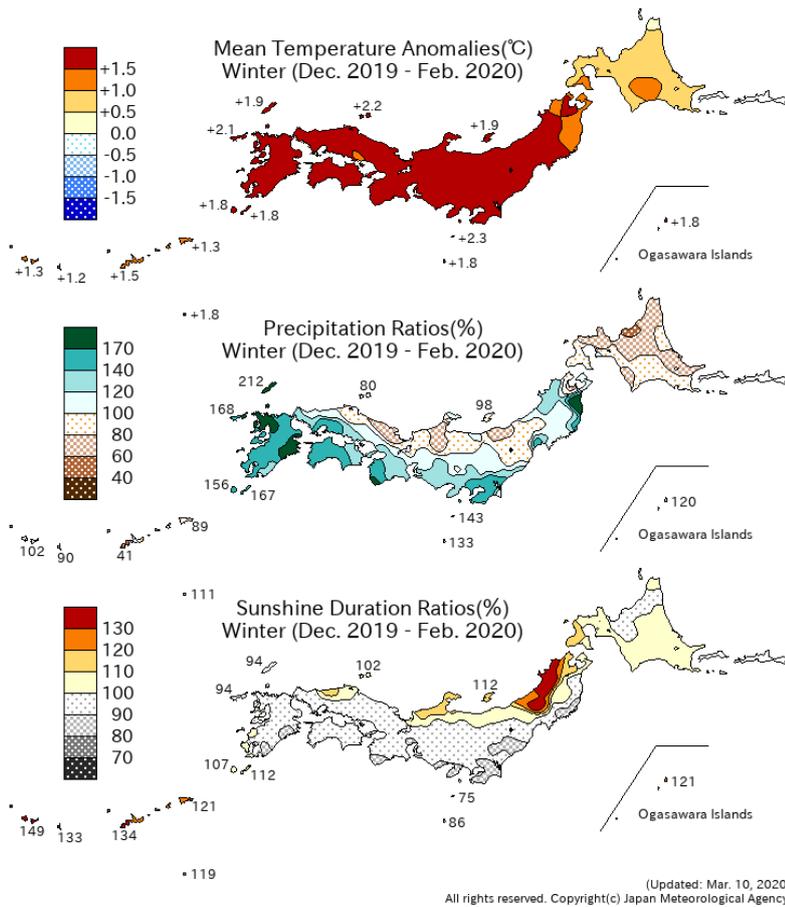


Fig. S1 Seasonal climate anomaly/ratio over Japan (December 2019 – February 2020)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1981-2010.

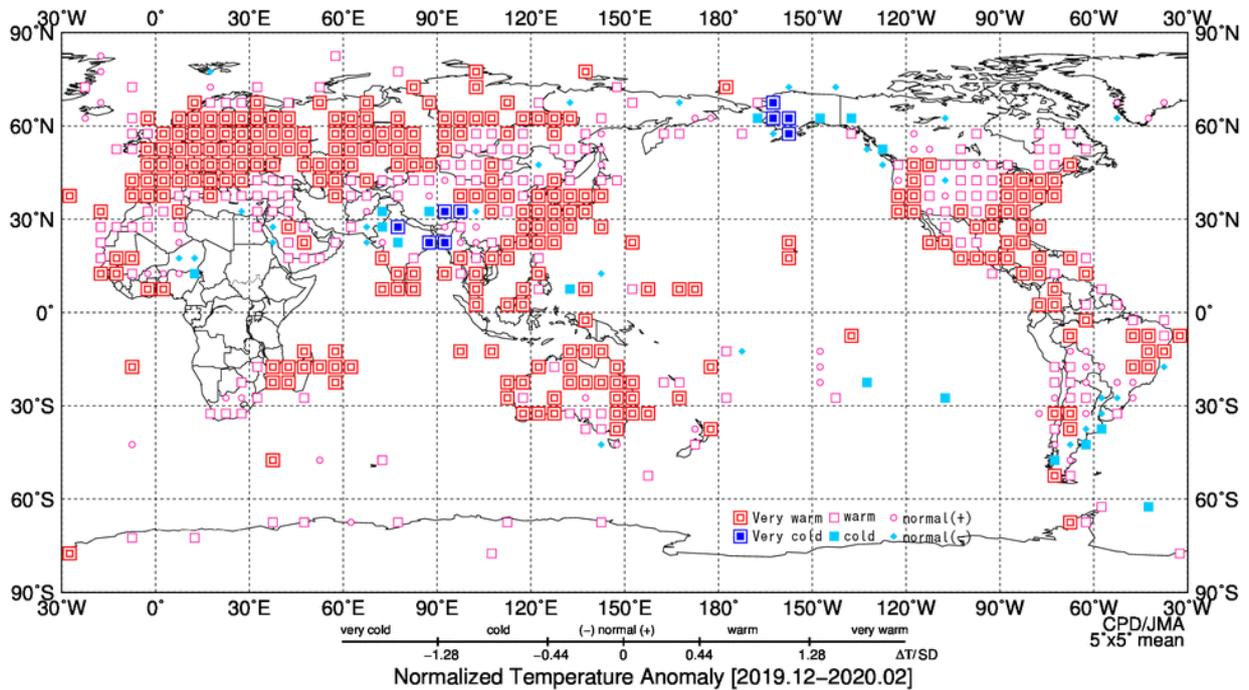


Fig. S2 Three-month mean temperature anomaly (normalized) category (December 2019 – February 2020)

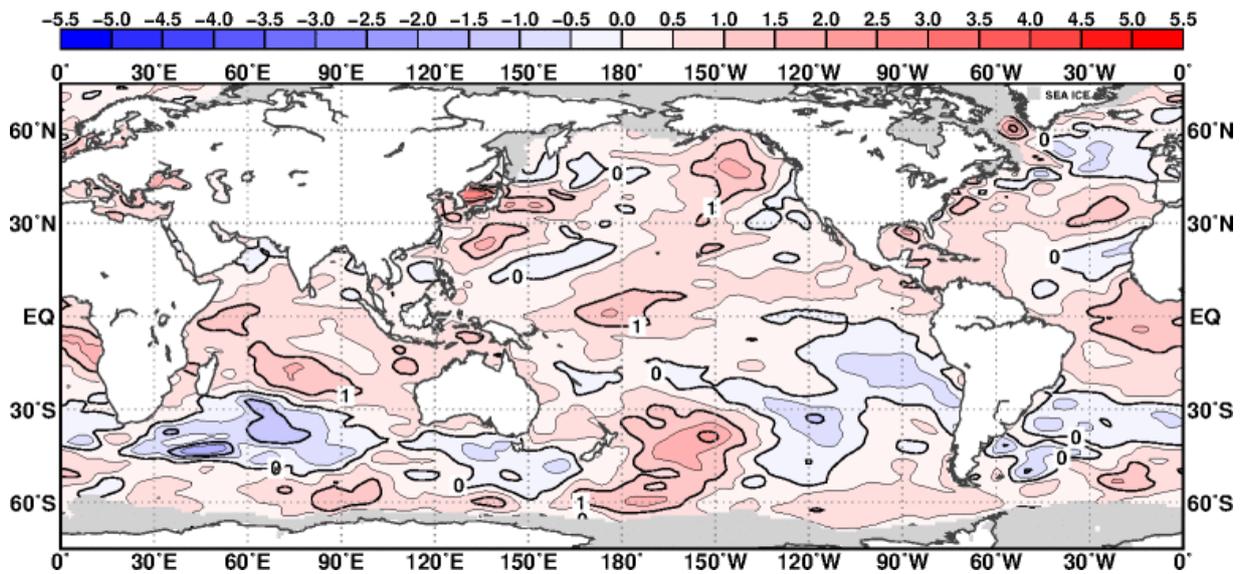


Fig. S3 Three-month mean sea surface temperature anomaly (December 2019 – February 2020)
The contour interval is 0.5 degree C. The base period for the normal is 1981-2010. Maximum coverage with sea ice is shaded in gray.

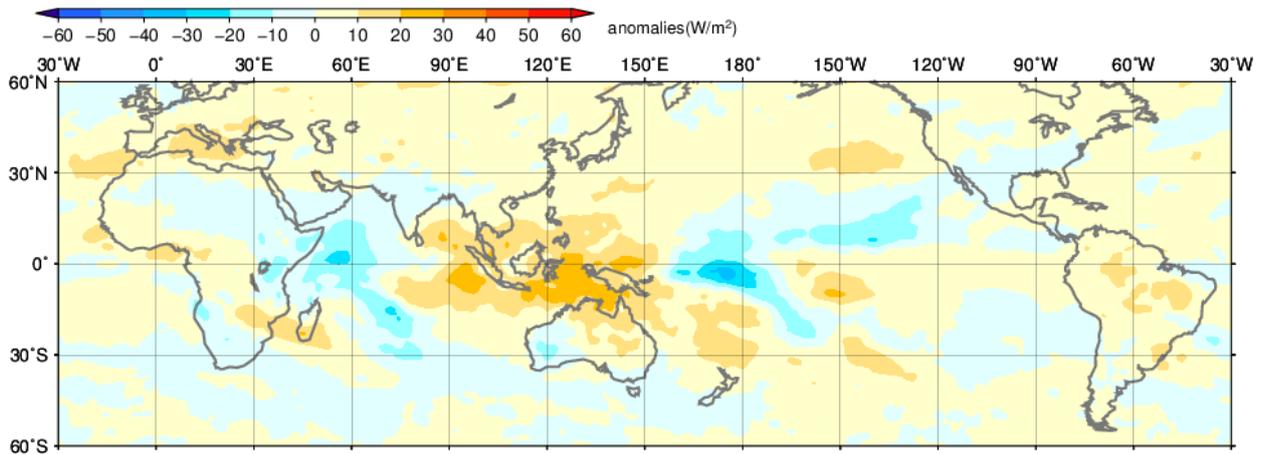


Fig. S4 Three-month mean Outgoing Longwave Radiation (OLR) anomaly (December 2019 – February 2020)
The contour interval is 10 W/m². The base period for the normal is 1981-2010. Original data provided by NOAA.

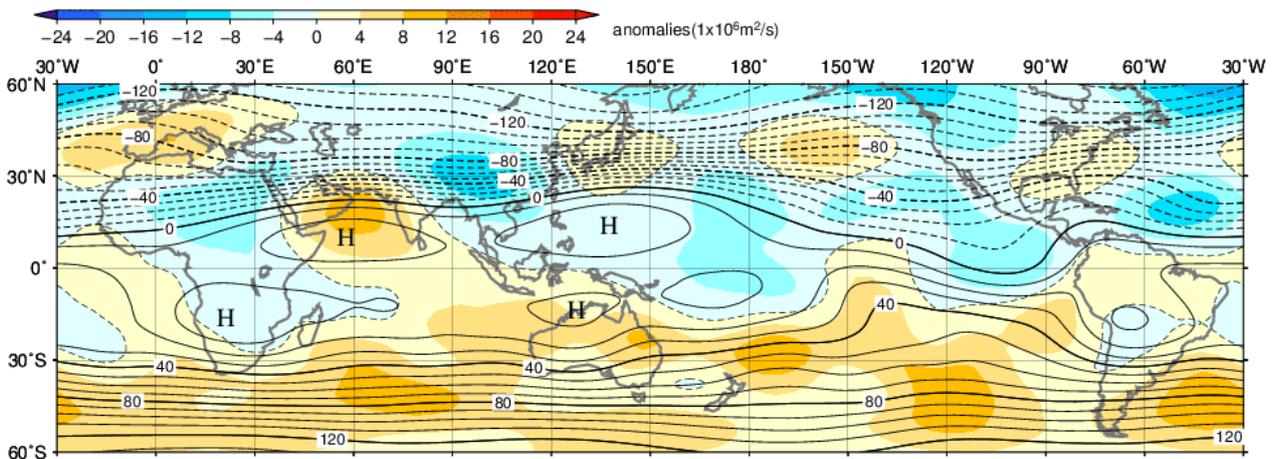


Fig. S5 Three-month mean 200-hPa stream function and anomaly (December 2019 – February 2020)
The contour interval is 10x10⁶ m²/s. The base period for the normal is 1981-2010.

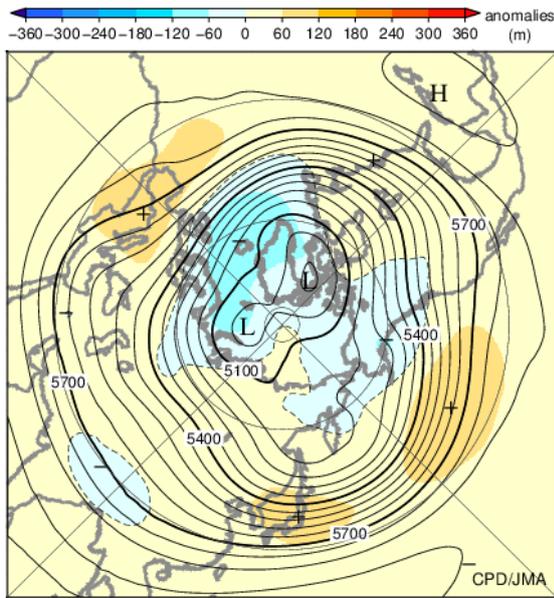


Fig. S6 Three-month mean 500-hPa height and anomaly in the Northern Hemisphere (December 2019 – February 2020)

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.

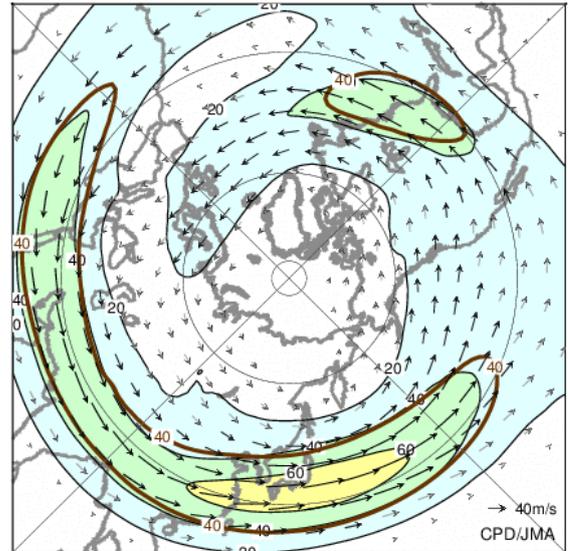


Fig. S7 Three-month mean 200-hPa wind speed and vectors in the Northern Hemisphere (December 2019 – February 2020)

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 1981-2010.

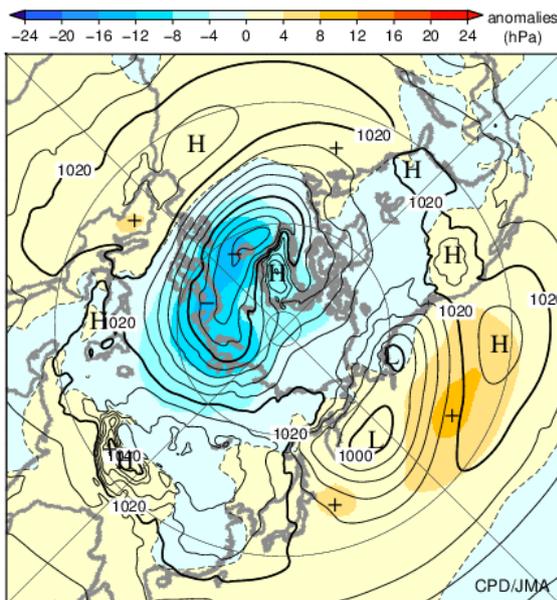


Fig. S8 Three-month mean sea level pressure and anomaly in the Northern Hemisphere (December 2019 – February 2020)

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.

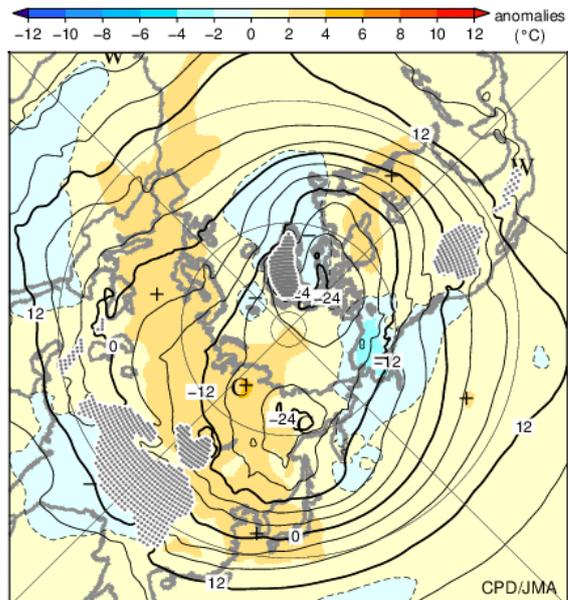


Fig. S9 Three-month mean 850-hPa temperature and anomaly in the Northern Hemisphere (December 2019 – February 2020)

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.