

Seasonal Highlights on the Climate System (December 2022 – February 2023)

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- La Niña event, which had persisted since boreal autumn 2021, is likely to have ended (see [El Niño Outlook](#) updated on 10 March 2023).
- Seasonal mean temperatures were above normal in Okinawa/Amami and below normal in northern Japan.
- Seasonal mean temperatures were extremely high in southeastern Europe, in the eastern USA, and in the southern part of South America.
- Convective activity was enhanced from the eastern Indian Ocean to near Southeast Asia, and suppressed near the date line in the equatorial Pacific.
- In the 500-hPa height field, the polar vortex in the Northern Hemisphere split with negative anomalies from Eastern Siberia to the northern part of East Asia.
- The subtropical jet stream shifted northward from its normal position from eastern Eurasia to the seas east of Japan. The polar-front jet stream meandered southward near Central to Eastern Siberia and meandered northward near the Bering Sea.

[Climate in Japan](#) (Fig. S1):

- Seasonal temperatures were below normal in northern Japan due to cold air inflow. On the other hand, seasonal temperatures were above normal in Okinawa/Amami, which was easily covered by warm-air.
- Seasonal precipitation amounts were above normal on the Sea of Japan side of eastern Japan due to winter monsoon. Seasonal precipitation amounts were below normal on the Pacific side of northern/eastern/western Japan and the Sea of Japan side of western Japan due to less passage of low pressure systems and fronts.
- Seasonal sunshine durations were above normal on the Sea of Japan side and the Pacific side of western Japan due to high-pressure systems that frequently covered the regions.

[World Climate](#) (Fig. S2):

- Seasonal mean temperatures were extremely high in southeastern Europe, in the eastern USA, and in the southern part of South America.
- Seasonal precipitation amounts were extremely high from western Russia to Belarus, from western Ukraine to Hungary, from the northern to central USA, and in the western USA.
- Seasonal precipitation amounts were extremely low in Uzbekistan, and from Uruguay to eastern Argentina.

[Oceanographic Conditions](#) (Fig. S3):

- In the equatorial Pacific, remarkably positive SST anomalies were observed in the western part, and negative SST anomalies were observed in the central to eastern parts.
- In the North Pacific, remarkably positive SST anomalies were observed in the central part and the western tropical region.
- In the South Pacific, remarkably positive SST anomalies were observed in the western tropical region, and remarkably negative SST anomalies were observed in the central tropical region.
- In the tropical Indian Ocean, negative SST anomalies were observed in the eastern part.
- In the North Atlantic, remarkably positive SST anomalies were observed in the latitude bands from 20°N to 40°N.

[Tropics:](#)

- Convective activity was enhanced from the eastern Indian Ocean to near Southeast Asia, and suppressed near the date line in the equatorial Pacific (Fig. S4).

- In the upper troposphere, anti-cyclonic circulation anomalies were seen from South Asia to the sea south of Japan. In the tropical area, cyclonic circulation anomalies straddling the equator were seen over the central Pacific (Fig. S5).
- In the lower troposphere over the tropical area, anti-cyclonic circulation anomalies straddling the equator were seen over the western to central Pacific, and cyclonic circulation anomalies straddling the equator were seen from the Indian Ocean to near Indonesia.
- In the sea level pressure field over the tropical area, positive anomalies were seen from the central Pacific to near South America, and negative anomalies were seen from the eastern Indian Ocean to the western Pacific.

Extratropics:

- In the 500-hPa height field (Fig. S6), the polar vortex in the Northern Hemisphere split with positive anomalies over the northern polar region and negative anomalies from Eastern Siberia to the northern part of East Asia. Wave trains were seen along the polar-front jet stream over Eurasia.
- The subtropical jet stream shifted northward from its normal position from eastern Eurasia to the seas east of Japan. The polar-front jet stream meandered southward near Central to Eastern Siberia and meandered northward near the Bering Sea (Fig. S7).
- In the sea level pressure field (Fig. S8), positive anomalies were seen over the northern polar region. The Siberian High was stronger than normal from the central to western part, and the Aleutian Low was stronger than normal in the northwestern part.
- Temperatures at 850-hPa were above normal over the northern polar region and the eastern part of North America, and below normal from Central/Eastern Siberia to the northern part of East Asia (Fig. S9).

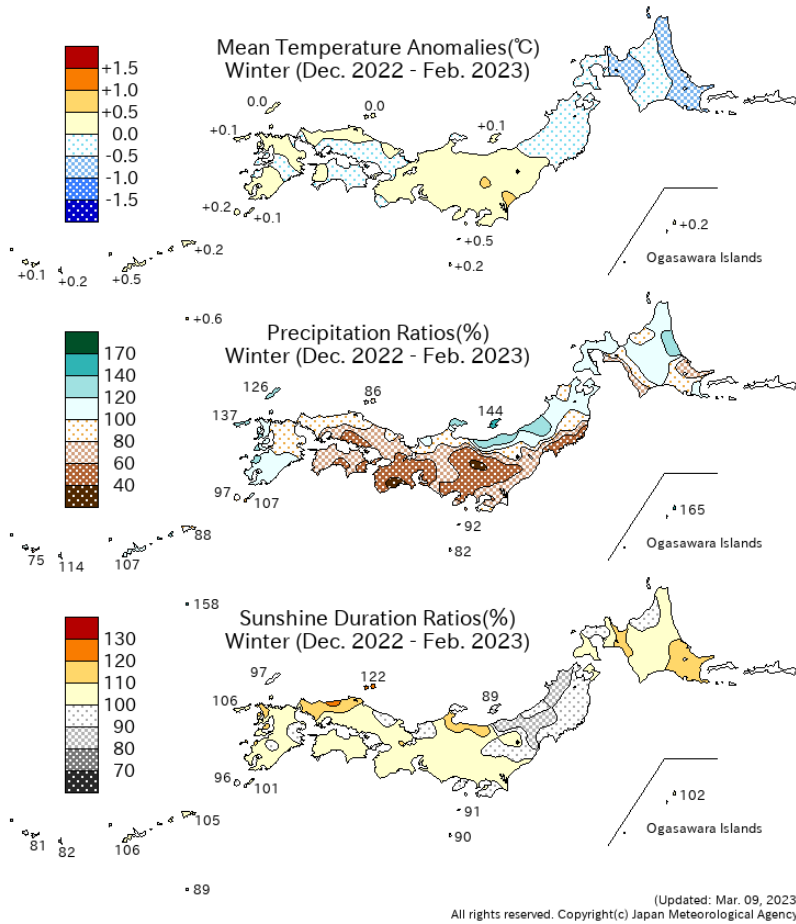


Fig. S1 Seasonal climate anomaly/ratio over Japan (December 2022 – February 2023)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1991-2020.

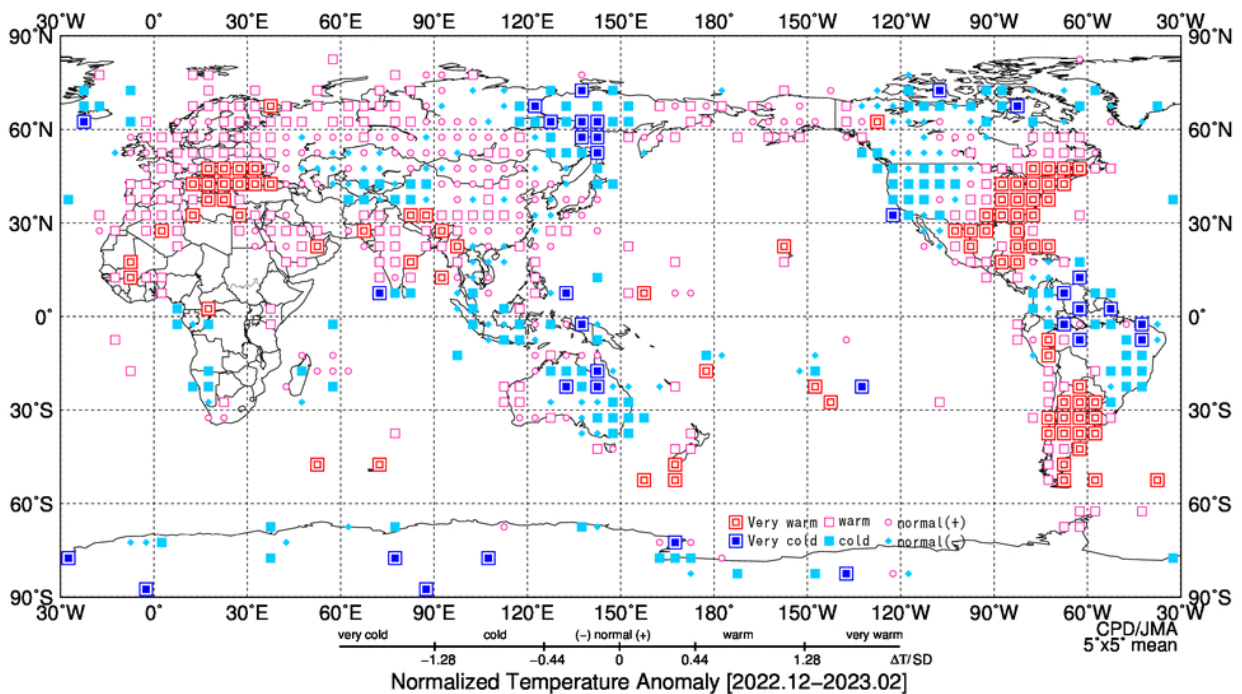


Fig. S2 Three-month mean temperature anomaly (normalized) category (December 2022 – February 2023)

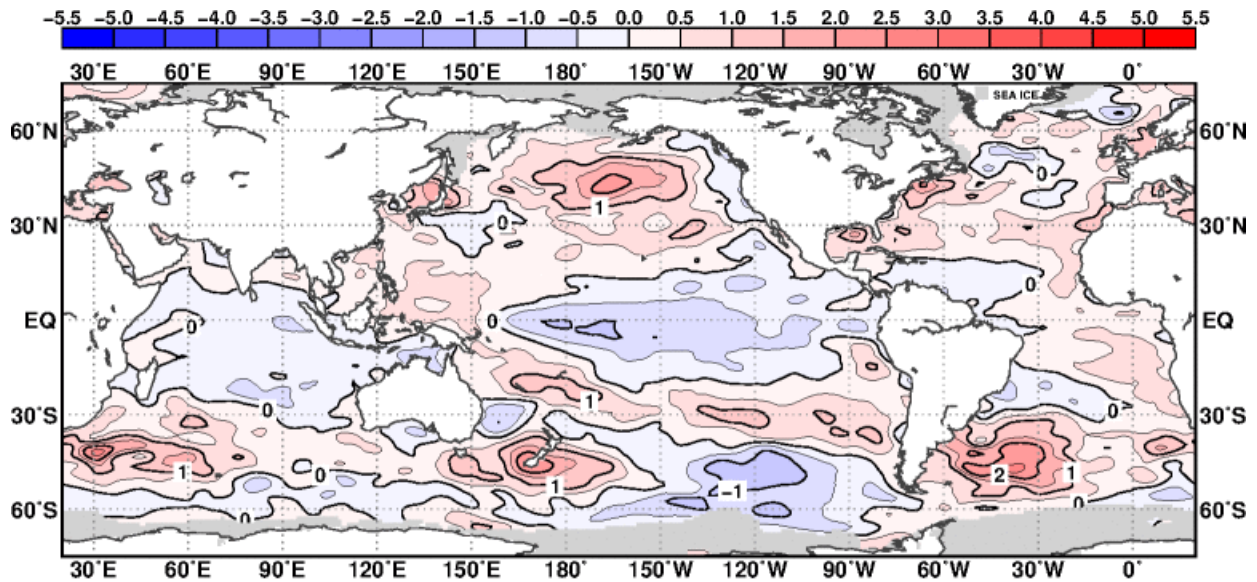


Fig. S3 Three-month mean sea surface temperature anomaly (December 2022 – February 2023)
The contour interval is 0.5 degree C. The base period for the normal is 1991-2020. Maximum coverage with sea ice is shaded in gray.

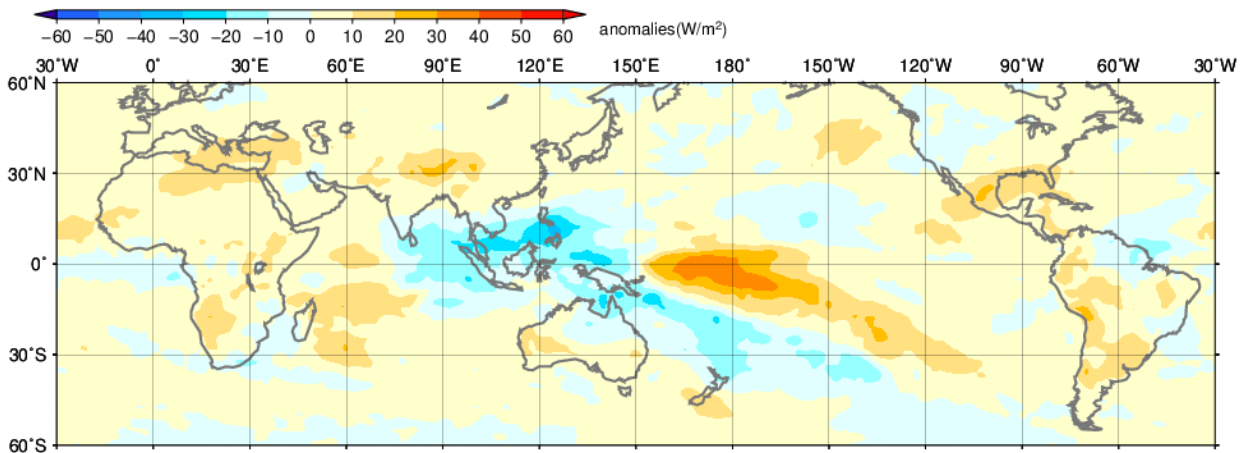


Fig. S4 Three-month mean Outgoing Longwave Radiation (OLR) anomaly (December 2022 – February 2023)
The shading interval is 10 W/m². The base period for the normal is 1991-2020. Original data provided by NOAA.

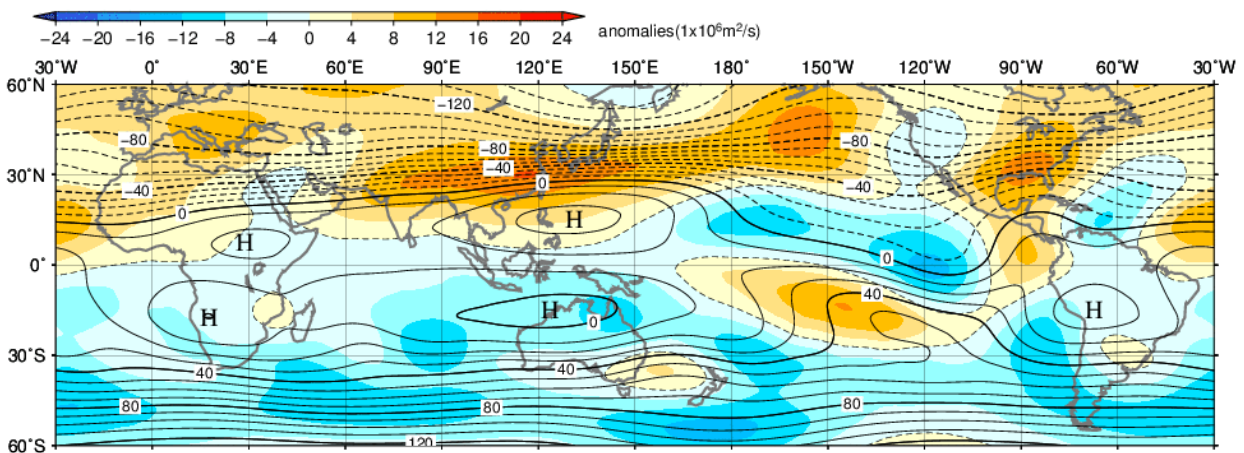


Fig. S5 Three-month mean 200-hPa stream function and anomaly (December 2022 – February 2023)
The contour interval is 10x10⁶ m²/s. The base period for the normal is 1991-2020.

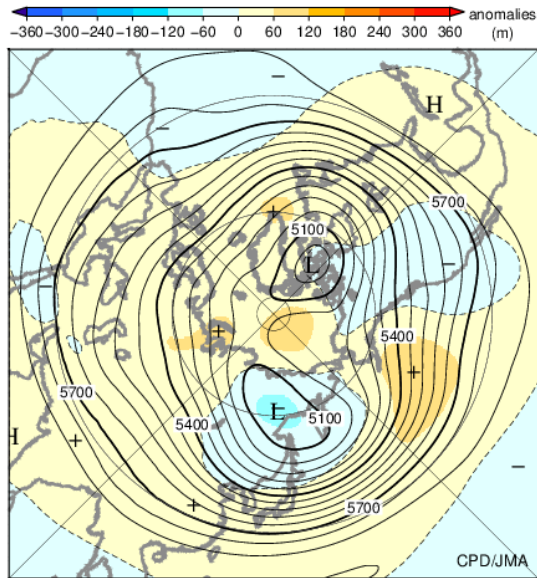


Fig. S6 Three-month mean 500-hPa height and anomaly in the Northern Hemisphere (December 2022 – February 2023)

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.

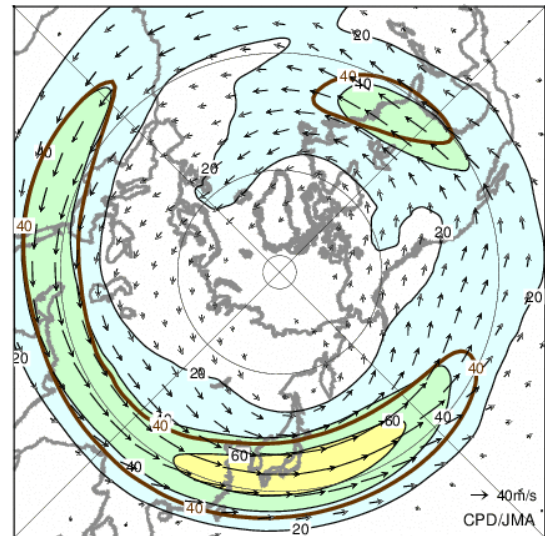


Fig. S7 Three-month mean 200-hPa wind speed and vectors in the Northern Hemisphere (December 2022 – February 2023)

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.

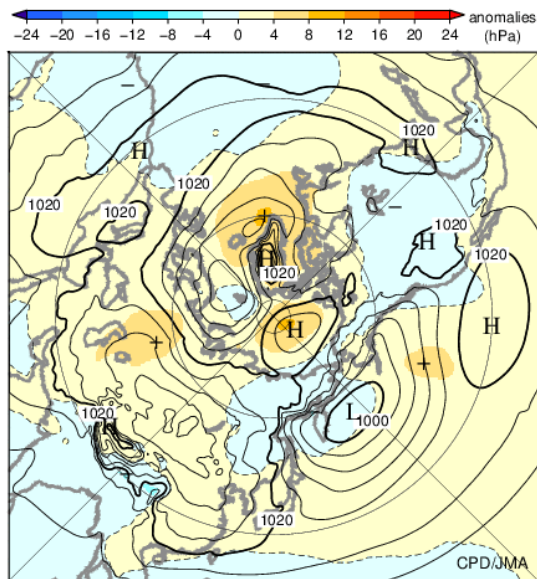


Fig. S8 Three-month mean sea level pressure and anomaly in the Northern Hemisphere (December 2022 – February 2023)

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.

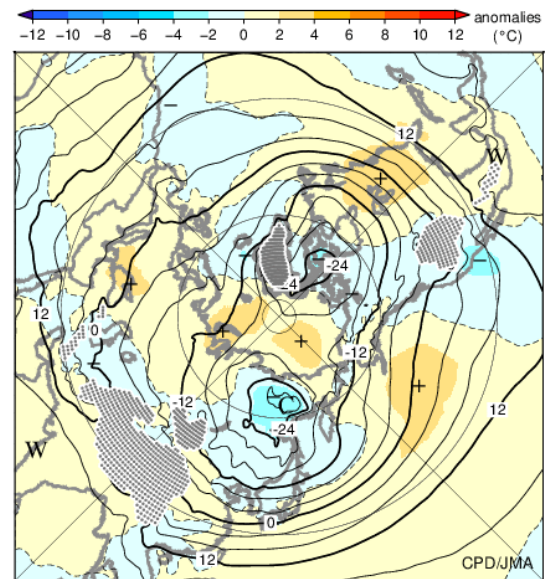


Fig. S9 Three-month mean 850-hPa temperature and anomaly in the Northern Hemisphere (December 2022 – February 2023)

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.