

## Seasonal Highlights on the Climate System (March 2019 – May 2019)

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- El Niño conditions continue in the equatorial Pacific (see [El Niño Outlook](#) updated on 10 June 2019).
- Seasonal mean temperatures were significantly above normal in northern and western Japan, and Okinawa/Amami.
- Seasonal mean temperatures were extremely high in and around the northeastern part of East Asia, and in and around southern China.
- Convective activity was enhanced from the west of the date line to the central equatorial Pacific, and was suppressed from the tropical North Indian Ocean to the Philippines.
- In the 500-hPa height field, positive anomalies were seen over Alaska and the east of Greenland, and negative anomalies were seen over the south of Greenland.
- The westerly jet stream shifted southward from its normal position from Japan to the eastern part of the North Pacific.

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

- Seasonal mean temperatures were significantly above normal in northern and western Japan, and Okinawa/Amami.
- Seasonal sunshine durations were significantly above normal in northern, eastern and western Japan, with the longest on record for spring since 1946 in northern Japan and on the Sea of Japan side of eastern and western Japan.
- Seasonal precipitation amounts were significantly below normal on the Sea of Japan side of northern Japan.

### World Climate (Fig. S2):

- Seasonal mean temperatures were extremely high from the northern part of Eastern Siberia to the northern part of Western Siberia, in and around the northeastern part of East Asia, in and around southern China, in southern India, from Seychelles to Mauritius, from the northeastern to central part of South Africa, in and around Alaska, in and around Brazil, and from eastern to southeastern Australia.
- Seasonal precipitation amounts were extremely high from eastern to southern Europe, in the northwestern part of Northern Africa, from southeastern Canada to the western USA, and from southern Paraguay to northern Argentina.
- Seasonal precipitation amounts were extremely low in and around southern China, from western to southwestern Spain, and in and around southwestern Canada.

### Oceanographic Conditions (Fig. S3):

- In the equatorial Pacific, remarkably positive SST anomalies were observed in almost the entire region except the area near Indonesia and east of 90°W.
- In the North Pacific, remarkably positive SST anomalies were observed from the South China Sea to the central part, from the area around the Aleutian Islands to the Gulf of Alaska and from the central part to the eastern part of the tropical region.
- In the South Pacific, remarkably positive SST anomalies were observed from east of the New Guinea Island to the area near 40°S, 80°W and from the southeastern coast of Australia to the area near 55°S, 140°W, and remarkably negative SST anomalies were observed in the area near 30°S, 135°W and near the western coast of Chile.
- In the Indian Ocean, remarkably positive SST anomalies were observed in almost the entire region, and remarkably negative SST anomalies were observed in the southwestern coast of Australia.

- In the North Atlantic, remarkably positive SST anomalies were observed from the Gulf of Mexico to the area near 30°N, 20°W, and remarkably negative SST anomalies were observed south of Greenland.

#### **Tropics:**

- Convective activity was enhanced from the west of the date line to the central equatorial Pacific and over the western and central equatorial South Indian Ocean, and was suppressed from the tropical North Indian Ocean to the Philippines, over the eastern tropical South Indian Ocean, and over the western and central tropical South Pacific (Fig. S4).
- In the upper troposphere, cyclonic circulation anomalies were seen from the Caribbean Sea to the Arabian Peninsula, and anti-cyclonic circulation anomalies were seen from southeastern China to the date line over the tropical North Pacific and around the date line over the tropical South Pacific (Fig. S5).
- In the lower troposphere, cyclonic circulation anomalies straddling the equator were seen around the western tropical Pacific, and anti-cyclonic circulation anomalies were seen over the North Indian Ocean.
- In the sea level pressure field, positive anomalies were seen over a wide area of tropical region except over the part of Africa and the central to eastern tropical Pacific.

#### **Extratropics:**

- In the 500-hPa height field (Fig. S6), positive anomalies were seen over Alaska and the east of Greenland, and negative anomalies were seen over the south of Greenland. Wave trains were seen from the date line to the eastern USA, and from the western part of North Atlantic to Greenland.
- The subtropical jet stream shifted southward from its normal position from Northern Africa to the Middle East. The westerly jet stream shifted southward from its normal position from Japan to the eastern part of the North Pacific, and was stronger than normal in the mid-latitudes of the North Atlantic (Fig. S7).
- In the sea level pressure field (Fig. S8), positive anomalies were seen over the northwestern USA and eastern Greenland, and negative anomalies were seen from the south of Greenland to northern Canada, and from the Kara Sea to the Bering Sea.
- Temperatures at 850-hPa were above normal over Central and Eastern Siberia, over Alaska and around Greenland, and below normal from eastern Canada to southern Greenland (Fig. S9).

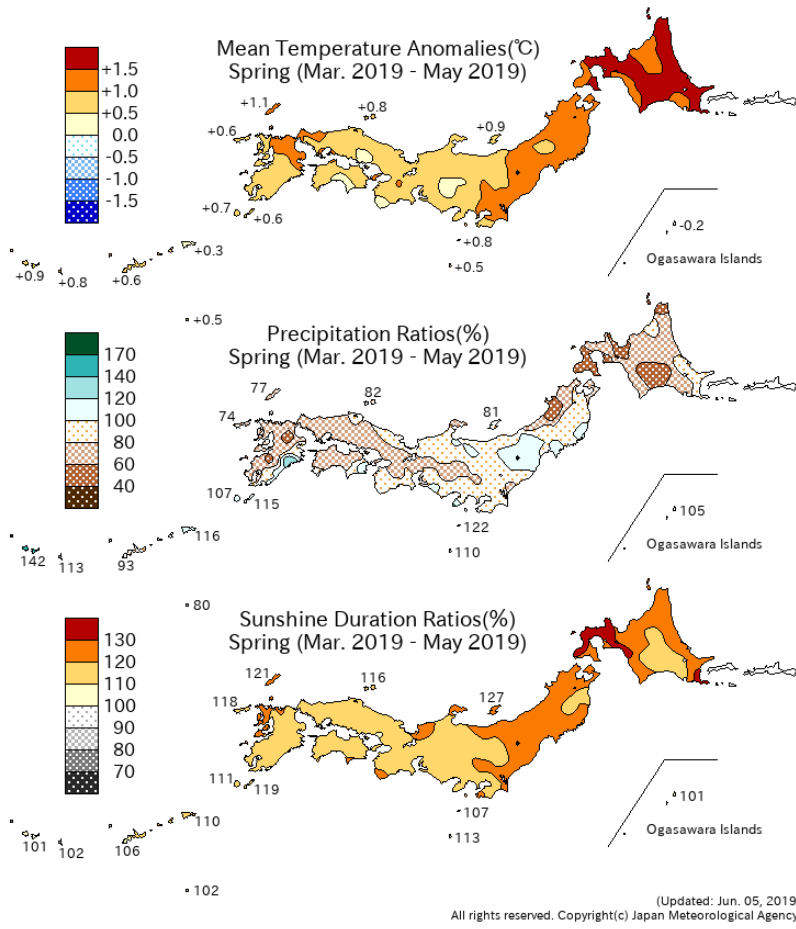


Fig. S1 Seasonal climate anomaly/ratio over Japan (March 2019 – May 2019)  
Top: temperature anomalies (degree C)  
Middle: precipitation ratio (%)  
Bottom: sunshine duration ratio (%)  
The base period for the normal is 1981-2010.

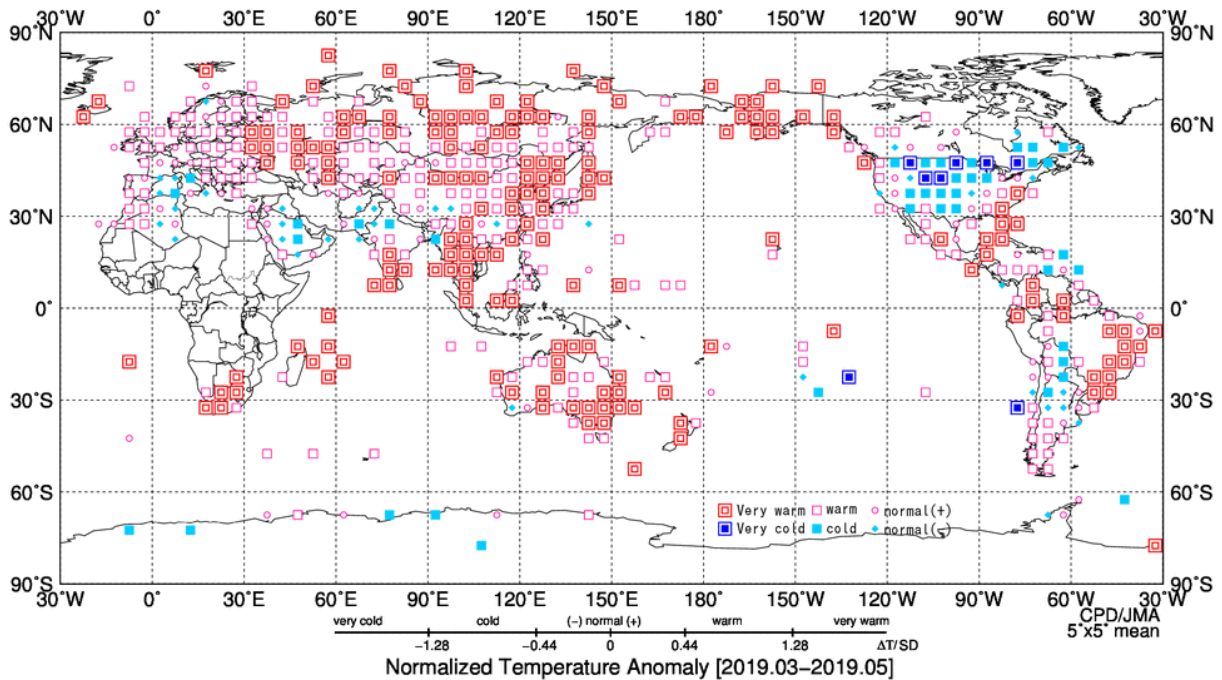


Fig. S2 Three-month mean temperature anomaly (normalized) category (March 2019 – May 2019)

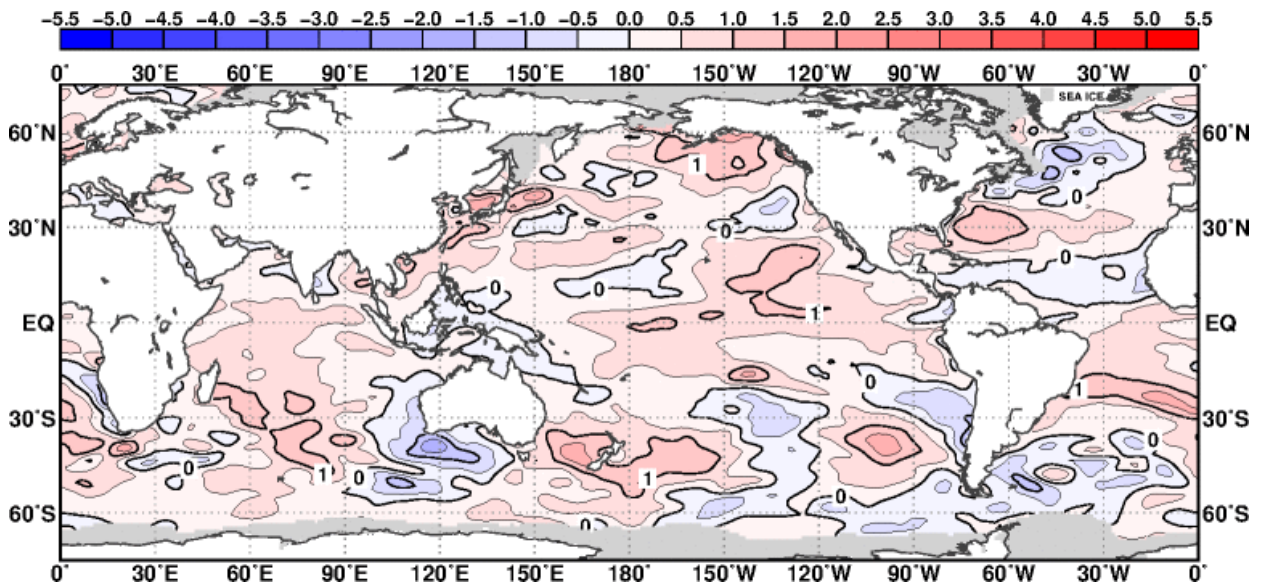


Fig. S3 Three-month mean sea surface temperature anomaly (March 2019 – May 2019)  
 The contour interval is 0.5 degree C. The base period for the normal is 1981-2010. Maximum coverage with sea ice is shaded in gray.

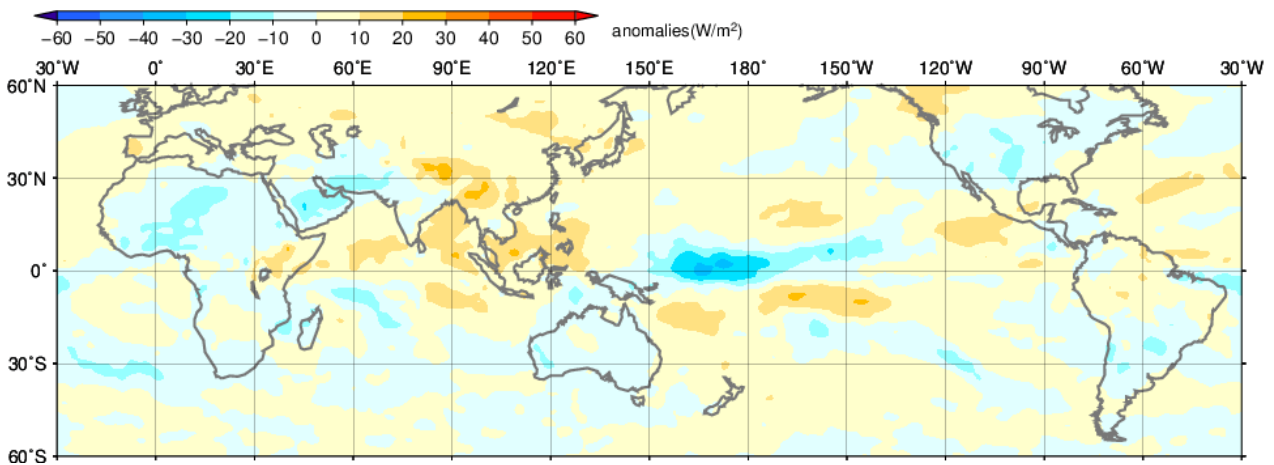


Fig. S4 Three-month mean Outgoing Longwave Radiation (OLR) anomaly (March 2019 – May 2019)  
 The contour interval is 10 W/m<sup>2</sup>. The base period for the normal is 1981-2010. Original data provided by NOAA.

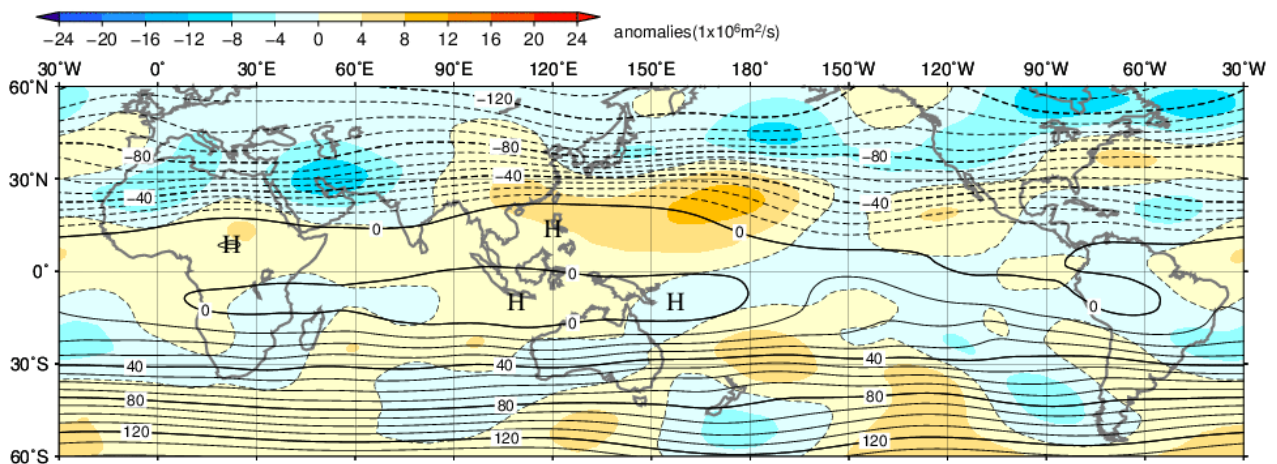


Fig. S5 Three-month mean 200-hPa stream function and anomaly (March 2019 – May 2019)  
 The contour interval is 10x10<sup>6</sup> m<sup>2</sup>/s. The base period for the normal is 1981-2010.



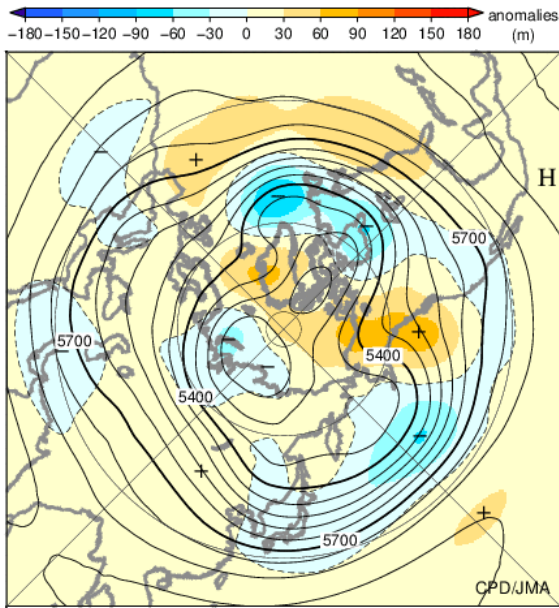


Fig. S6 Three-month mean 500-hPa height and anomaly in the Northern Hemisphere (March 2019 – May 2019)

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.

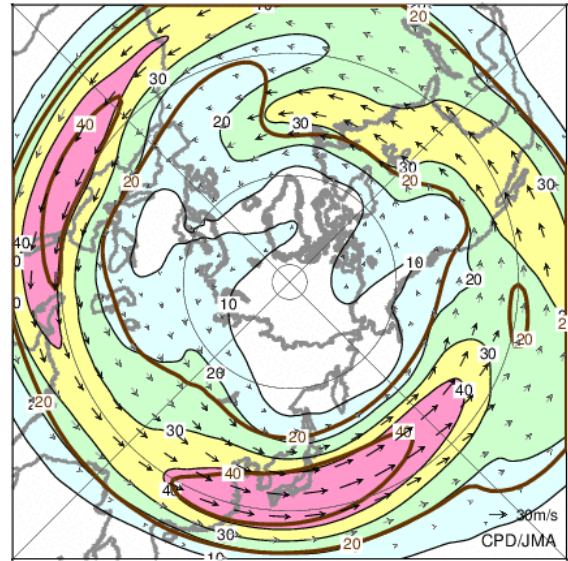


Fig. S7 Three-month mean 200-hPa wind speed and vectors in the Northern Hemisphere (March 2019 – May 2019)

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.

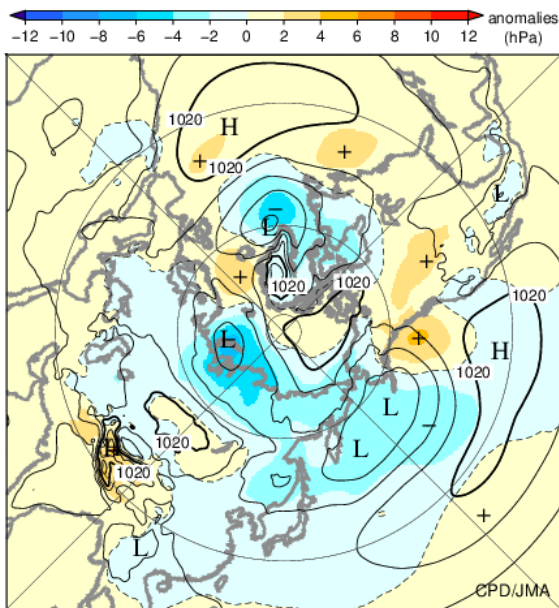


Fig. S8 Three-month mean sea level pressure and anomaly in the Northern Hemisphere (March 2019 – May 2019)

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.

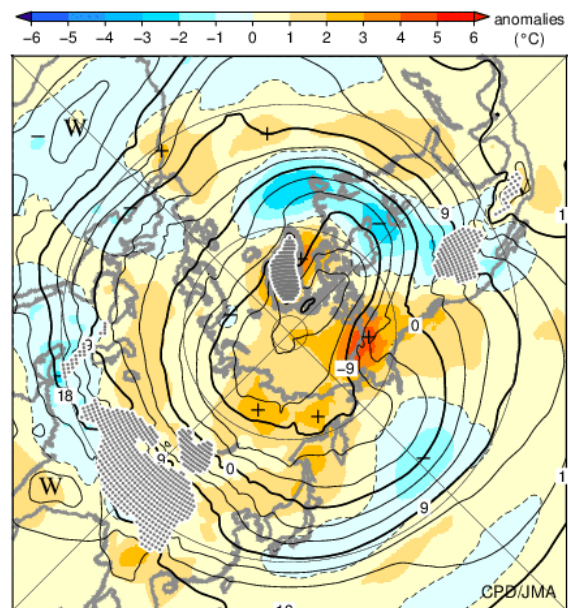


Fig. S9 Three-month mean 850-hPa temperature and anomaly in the Northern Hemisphere (March 2019 – May 2019)

The contours show 850-hPa temperature at intervals of 3 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.