Monthly Highlights on the Climate System (May 2017)

Highlights in May 2017

- Monthly mean temperatures were significantly above normal and monthly precipitation amounts were below normal in northern to western Japan.
- The monthly anomaly of the global average surface temperature was the third warmest since 1891.
- In the equatorial Pacific, positive SST anomalies were dominant except around 170˚E and 100˚W.
- Convective activity was enhanced from the central Indian Ocean to the Maritime Continent.
- The subpolar jet stream was clearly seen over Eurasia. The subtropical jet stream over Asia was displaced southward from its normal position.

Climate in Japan (Fig. 1):

- Monthly mean temperatures were significantly above normal in northern to western Japan because of warm southerly wind and above normal sunshine duration.
- Since high pressure systems frequently covered northern to western Japan, monthly precipitation amounts were significantly below normal in eastern Japan and the Sea of Japan side of western Japan.
- Monthly sunshine durations were significantly above normal in western Japan and on the Sea of Japan side of eastern Japan. Cloudy and rainy days were dominant in Okinawa/Amami due to Baiu-front and moist air flow.

World Climate:

- The monthly anomaly of the global average surface temperature in May 2017 (i.e., the combined average of the near-surface air temperature over land and the SST) was +0.36 °C (3rd warmest since 1891) (preliminary value) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.71°C per century in May (preliminary value).
- Extreme climate events were as follows (Fig. 3).
  - Monthly mean temperatures were extremely high from eastern Japan to Mongolia and monthly precipitation amounts were extremely low from eastern Japan to the southern Korean Peninsula.
  - Monthly mean temperatures were extremely low from northwestern Russia to the northern Scandinavian Peninsula.
  - Monthly mean temperatures were extremely high from western Europe to the western part of Northern Africa.

Oceanographic Conditions (Fig. 4):

- In the equatorial Pacific, positive SST anomalies were dominant except around 170˚E and 100˚W. The monthly mean SST anomaly and the SST deviation from the latest sliding 30-year mean in the NINO.3 region were both +0.5˚C (Fig. 5).
- In the North Pacific, remarkably positive SST anomalies were observed east of the Philippines, from near 15˚N, 145˚E to near 30˚N, 135˚W and near the Aleutian Islands, and remarkably negative SST anomalies were observed south of the Aleutian Islands. In the South Pacific, remarkably positive SST anomalies were widely observed north of 30˚S.
- In the Indian Ocean, remarkably positive SST anomalies were observed from the eastern coast of East Africa to near 35˚S, 105˚E and in the Bay of Bengal.
- In the North Atlantic, remarkably positive SST anomalies were observed near the eastern coast of North America and near the western coast of North Africa.

Tropics:

- Convective activity was enhanced from the central Indian Ocean to the Maritime Continent and over Central America, and suppressed from the seas east of the Philippines to the date line in the North Pacific (Fig. 6). The overall Asian summer monsoon activity was stronger than normal.
- The active phase of equatorial intraseasonal oscillations propagated eastward from South America to the Indian Ocean in the first half of May, and over the Indian Ocean in late May (Fig. 7).
- In the upper troposphere, anti-cyclonic circulation anomalies straddling the equator were seen from the eastern Indian Ocean to the Maritime Continent. The wave trains were seen from Northern Africa to the seas southeast of Japan along the subtropical jet stream (Fig. 8).
- In the lower troposphere, anti-cyclonic circulation anomalies were seen over a wide area of the Pacific. The westward extension of the Pacific High was stronger than normal.
- In the sea level pressure field, positive anomalies were seen over a wide area of the tropics. The Southern Oscillation Index value was +0.3 (Fig. 5).

Extratropics:

- In the 500-hPa height field (Fig. 9), a blocking high was developed around Iceland and the polar vortex was located from Western Russia to Central Siberia. In the mid-latitudes, positive anomalies were observed in western Europe, over the area from Central Asia to northeastern China and around northern Japan.
- The subpolar jet stream was clearly seen over Eurasia (Fig. 10). The subtropical jet stream over Asia was displaced southward from its normal position.
- In the sea level pressure field (Fig. 11), high-pressure system was centered near the North Pole. Negative anomalies distributed from northeastern China to the Bering Sea, while positive anomalies extended to the south. The Pacific High was generally stronger than normal.
- Temperatures at 850-hPa were above normal from western Europe to western part of Northern Africa, Central – East Asia, Canada and the western USA, and below normal from northern Europe to Central Siberia (Fig. 12).
- Zonal mean temperatures in the troposphere were above normal over the tropics and the mid-latitudes.

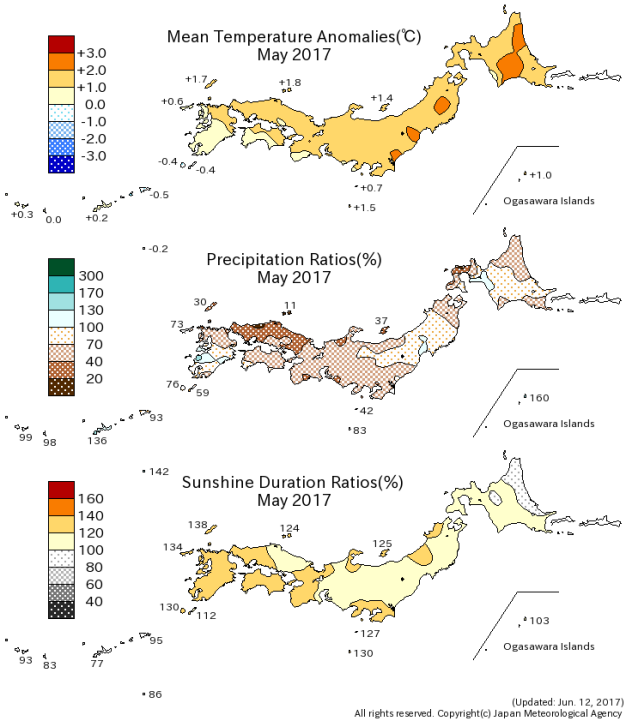

Fig. 1 Monthly climate anomaly/ratio over Japan (May 2017)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
The base period for the normal is 1981-2010 .

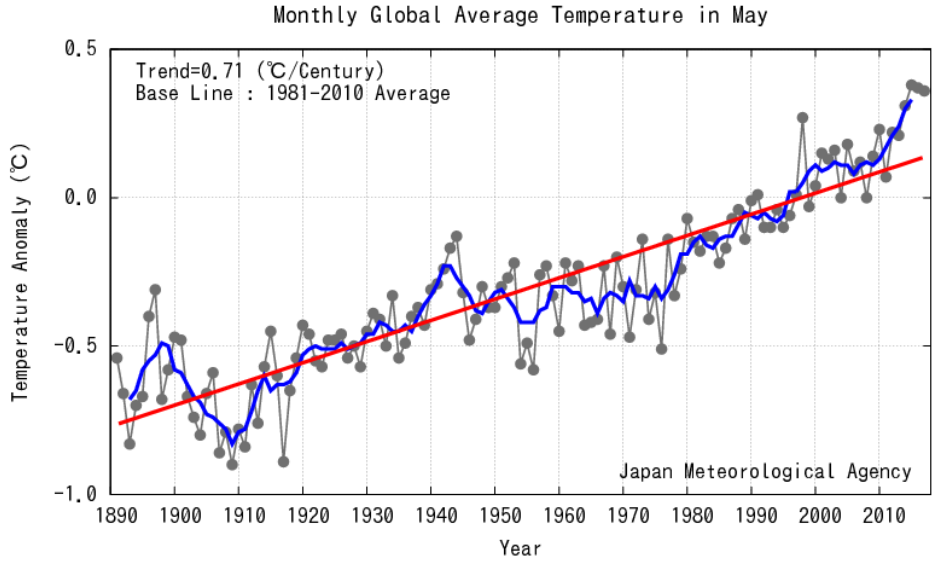

Fig. 2 Long-term change in monthly anomalies of global average surface temperature in May
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations from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

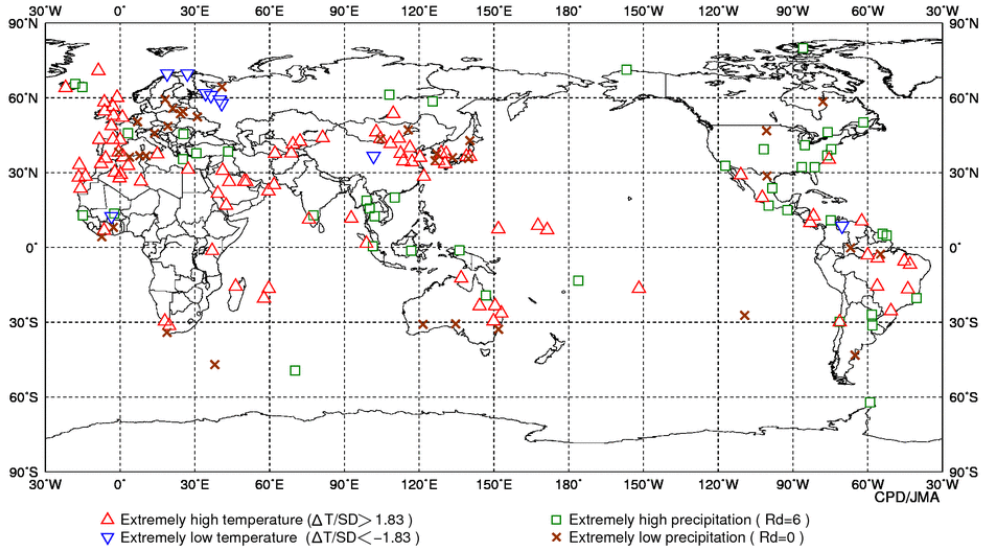

Fig. 3 Distribution of extreme climate events (May 2017)

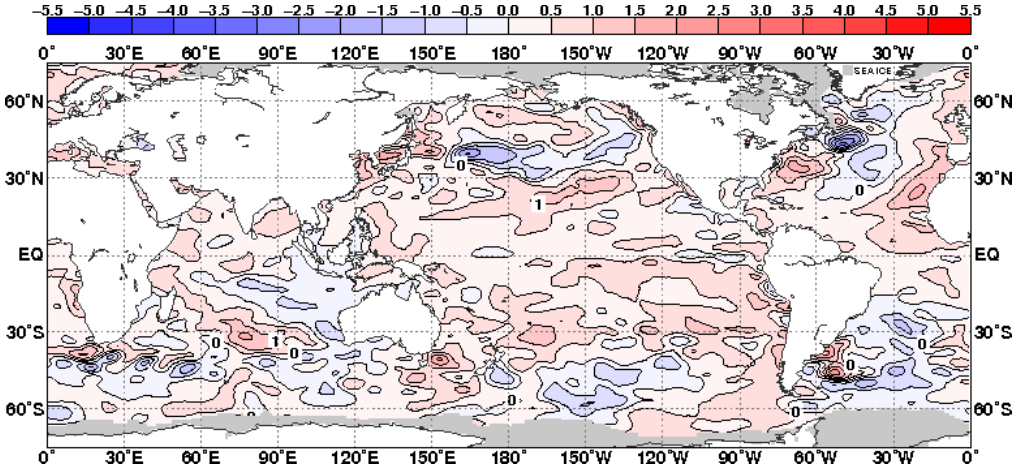

Fig. 4 Monthly mean sea surface temperature anomaly (May 2017)
The contour interval is 0.5 degree C. The base period for the normal is 1981-2010. Maximum coverage with sea ice is shaded in gray.

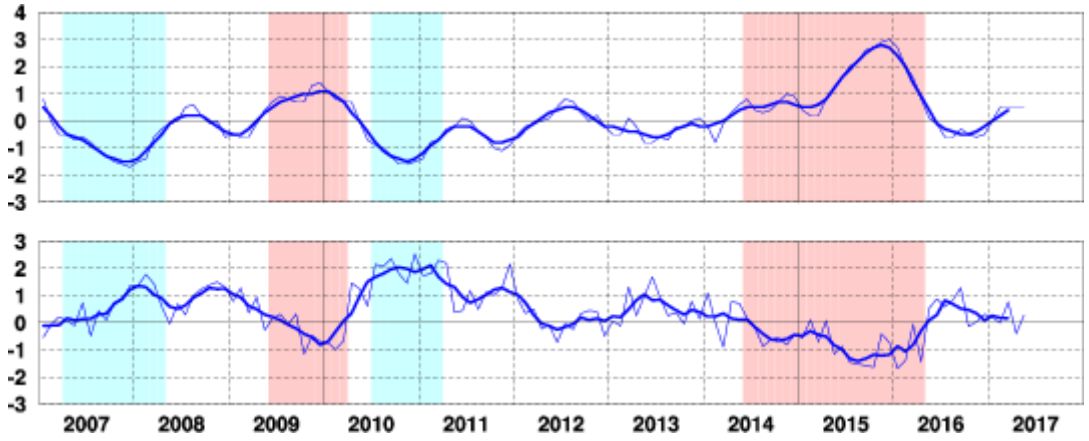

Fig. 5 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1981-2010 base period (lower).
Thin blue lines represent monthly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

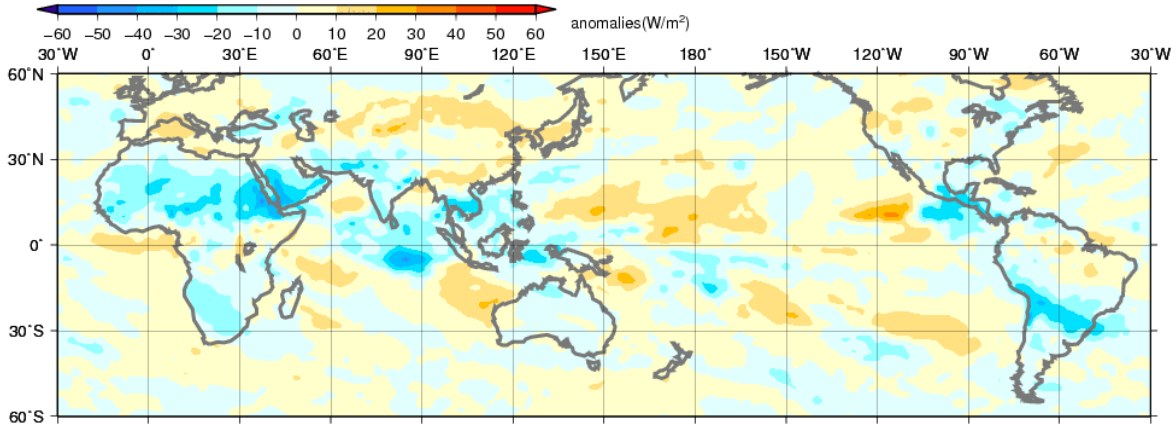

Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (May 2017)
The contour interval is 10 W/m^2. The base period for the normal is 1981-2010. Original data provided by NOAA.

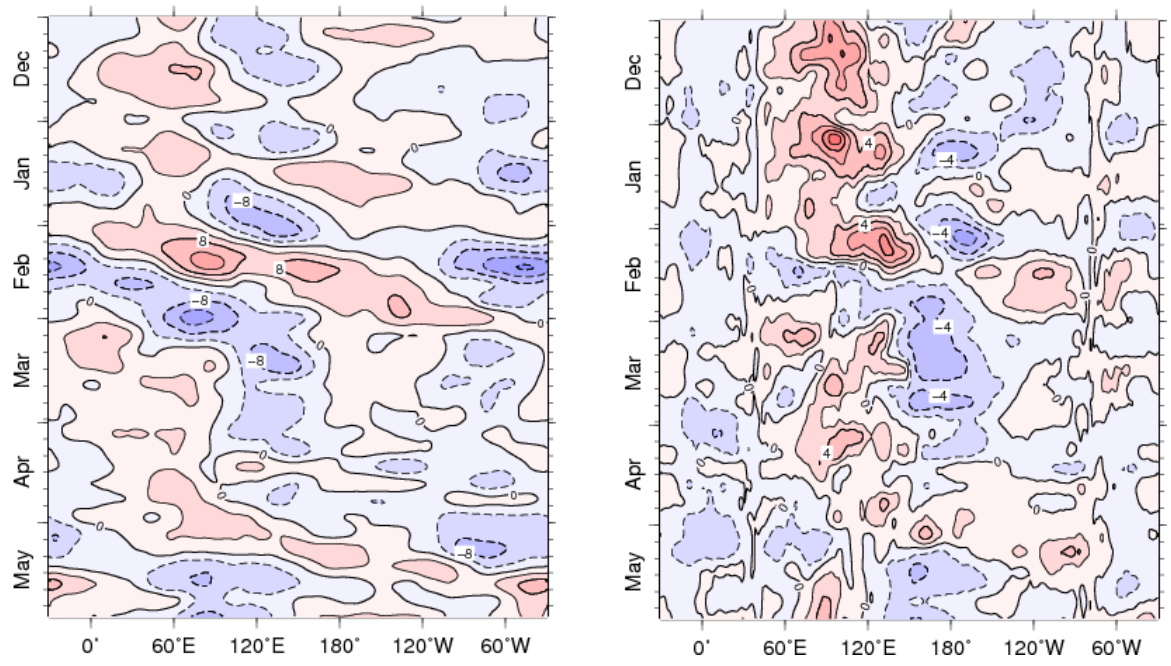

Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (December 2016 – May 2017)
The contour intervals are 4x10^6 m^2/s (left) and 2 m/s (right). The base period for the normal is 1981-2010.

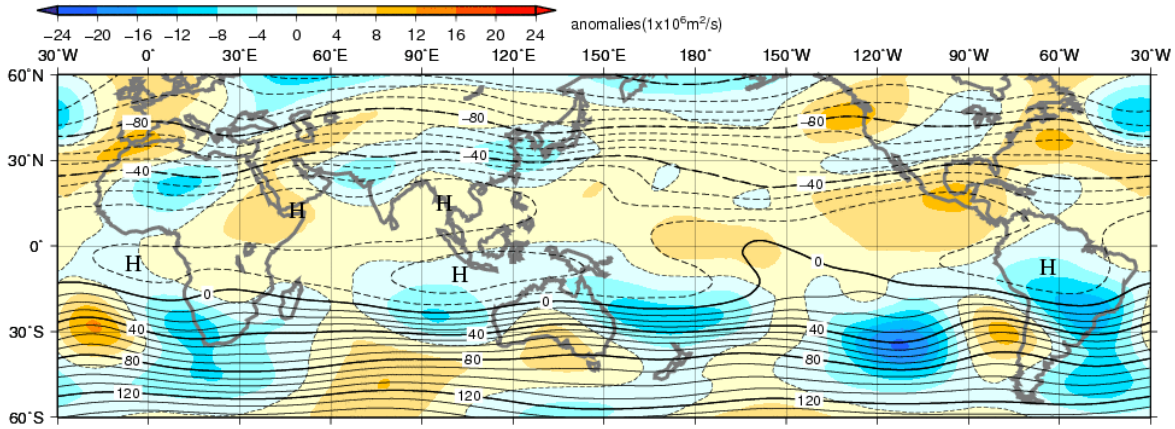

Fig. 8 Monthly mean 200-hPa stream function and anomaly (May 2017)
The contour interval is $10x10^6$ m^2/s. The base period for the normal is 1981-2010.

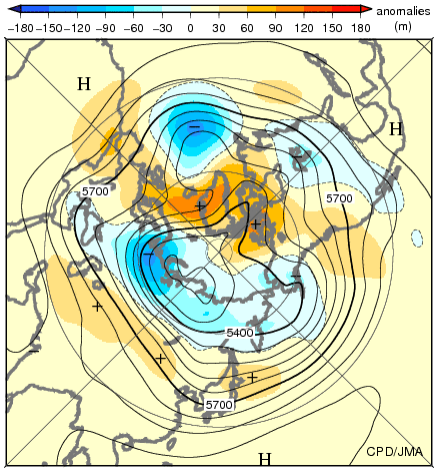

Fig. 9 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (May 2017)

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.

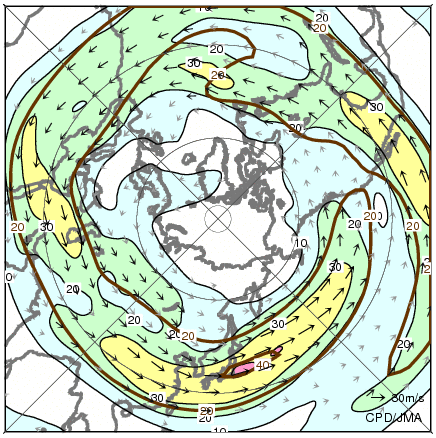

Fig. 10 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (May 2017)

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.

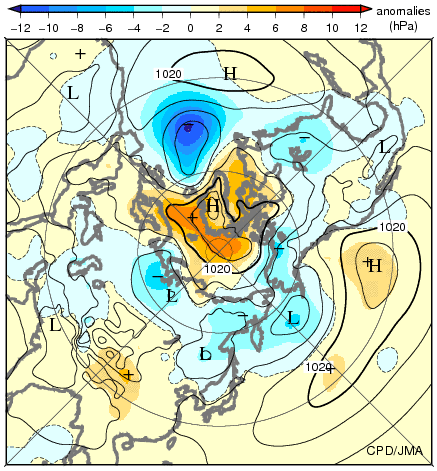

Fig. 11 Monthly mean sea level pressure and anomaly in the Northern Hemisphere (May 2017)

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.

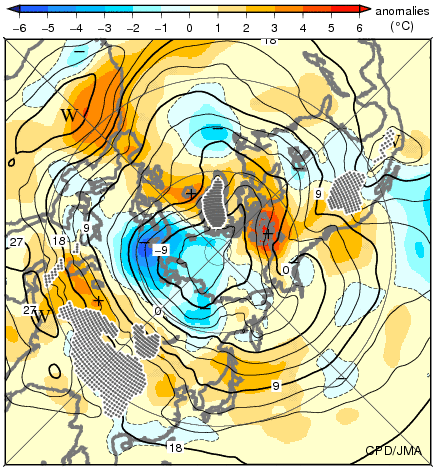

Fig. 12 Monthly mean 850-hPa temperature and anomaly in the Northern Hemisphere (May 2017)

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.
http://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.

Seasonal Highlights (March 2017 – May 2017)

- In northern to western Japan, seasonal mean temperatures were above normal and seasonal precipitation amounts were below normal.
- Seasonal mean temperatures were extremely high from Eastern Siberia to Mongolia, and the Korean Peninsula to eastern China.
- In the equatorial Pacific, remarkably positive SST anomalies were observed in almost the entire region except around the date line.
- Convective activity was enhanced over the Maritime Continent and suppressed around the date line.
- The subtropical jet stream shifted southward of its normal position around Japan.

Oceanographic Conditions (Fig. S3)**:**

- In the equatorial Pacific, remarkably positive SST anomalies were observed in almost the entire region except around the date line.
- In the North Pacific, remarkably positive SST anomalies were observed from east of the Philippines to near the western coast of North America. In the South Pacific, remarkably positive SST anomalies were widely observed from the northeastern coast of Australia to the western coast of South America.
- In the Indian Ocean, remarkably positive SST anomalies were observed from south of Madagascar to near 35˚S, 90˚E, and remarkably negative SST anomalies were observed from near 10˚S, 75˚E to the southwestern coast of Australia.
- In the North Atlantic, remarkably positive SST anomalies were observed near the eastern coast of North America and near the western coast of North Africa.

Tropics:

- Convective activity was enhanced over the Maritime Continent and the latitude bands of 10^{o}S in the central – eastern Pacific (Fig. S4). It was suppressed over the western – central Indian Ocean and around the date line of the North Pacific.
- In the upper troposphere, anti-cyclonic circulation anomalies straddling the equator were seen from the Indian Ocean to the western Pacific (Fig. S5). Cyclonic and anti-cyclonic circulation anomalies were seen over the eastern part of Northern Africa and the Middle East, respectively.
- In the lower troposphere, anti-cyclonic circulation anomalies straddling the equator were seen over the western Pacific. The subtropical high over the North Pacific was stronger than normal over its southern parts.

Extratropics:

- In the 500-hPa height field (Fig. S6), wave trains were observed from the Atlantic to Eurasia along the subpolar jet stream, with positive anomalies over the western Europe and around the Lake Baikal and negative anomalies from northern Europe to Western Russia. Negative anomalies zonally extended from around Japan to the central Pacific.
- The subtropical jet stream shifted southward of its normal position from around Japan to the central Pacific (Fig. S7).
- In the sea level pressure field (Fig. S8), negative anomalies were widely distributed from northeastern China to the east of Japan, while positive anomalies extended to the south of Japan.
- Temperatures at 850-hPa temperature were above normal from western Europe to the western part of Northern Africa, Central – Eastern Siberia, northern East Asia and the USA, and below normal from southeastern China to western Japan (Fig. S9).

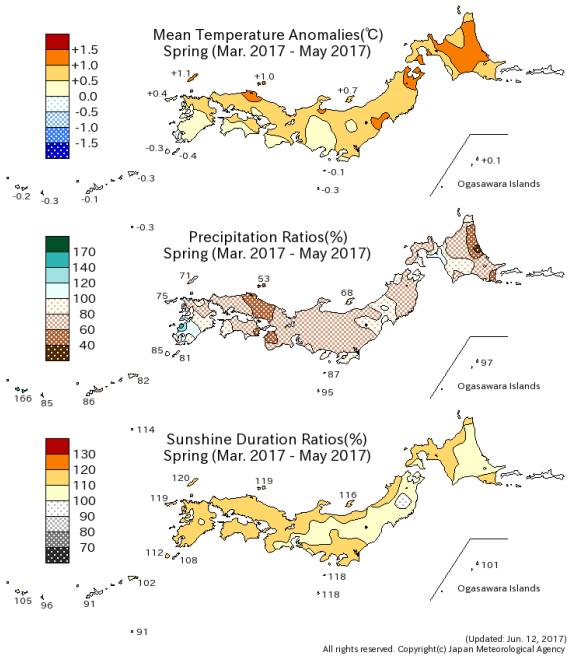

Fig. S1 Seasonal climate anomaly/ratio over Japan (March 2017 - May 2017)
Top: Temperature anomalies (degree C)
Middle: Precipitation ratio (%)
Bottom: Sunshine duration ratio (%)
The base period for the normal is 1981-2010.

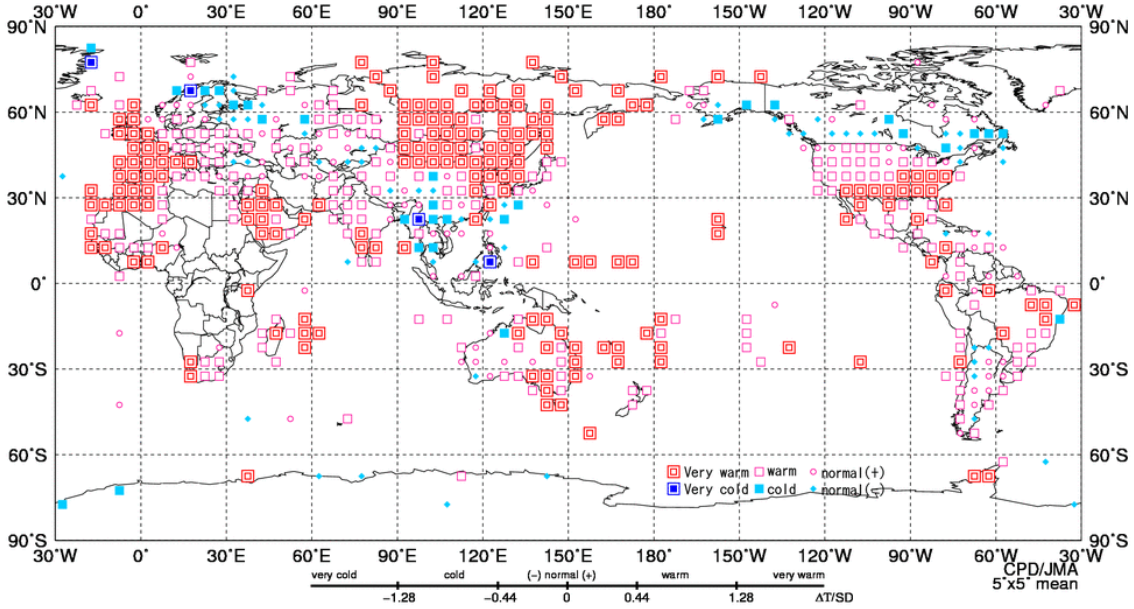

Fig. S2 Three-month mean temperature anomaly (normalized) category (March 2017 - May 2017)

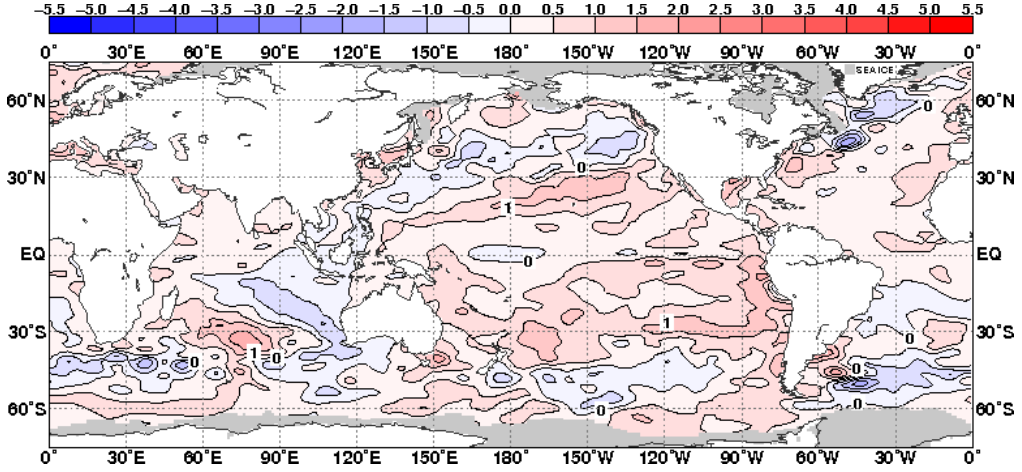

Fig. S3 Three-month mean sea surface temperature anomaly (March 2017 - May 2017)
The contour interval is 0.5 degree C. The base period for the normal is 1981-2010.

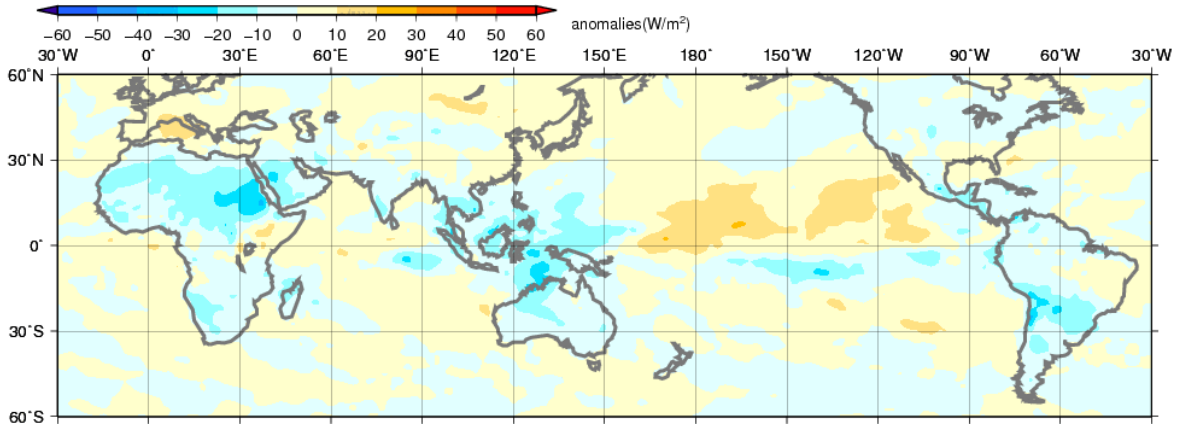

Fig. S4 Three-month mean Outgoing Longwave Radiation (OLR) anomaly (March 2017 - May 2017)
The contour interval is 10 W/m^2. The base period for the normal is 1981-2010. Original data provided by NOAA.

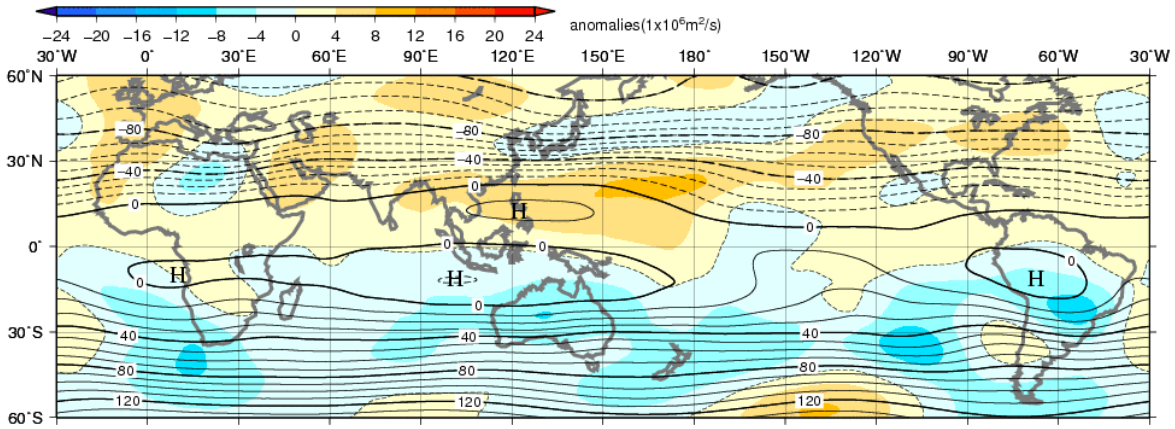

Fig. S5 Three-month mean 200-hPa stream function and anomaly (March 2017 - May 2017)
The contour interval is 10x10^6 m^2/s. The base period for the normal is 1981-2010.

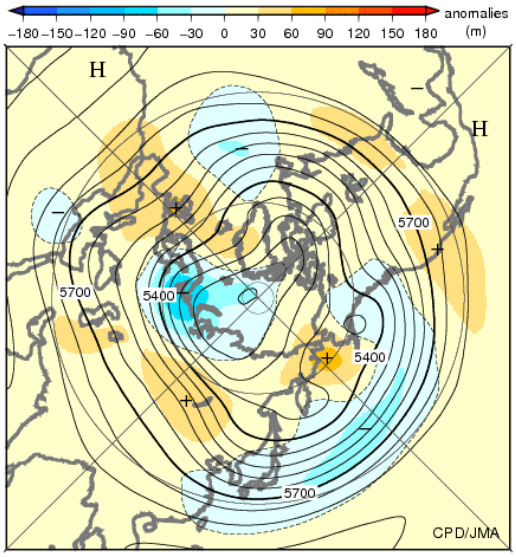

Fig. S6 Three-month mean 500-hPa height and anomaly in the Northern Hemisphere (March 2017 - May 2017)
The contour interval is 60 m. The shading shows anomalies. The base period for the normal is 1981-2010.

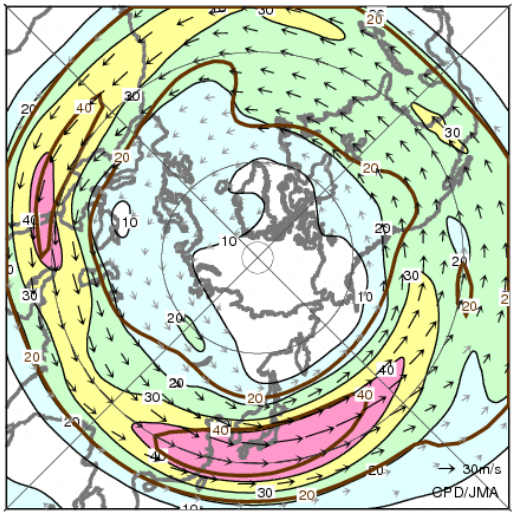

Fig. S7 Three-month mean 200-hPa wind speed and vectors in the Northern Hemisphere (March 2017 - May 2017)
The black lines show wind speeds at intervals of 10 m/s. The brown lines show normal wind speeds at intervals of 20 m/s. The base period for the normal is 1981-2010.

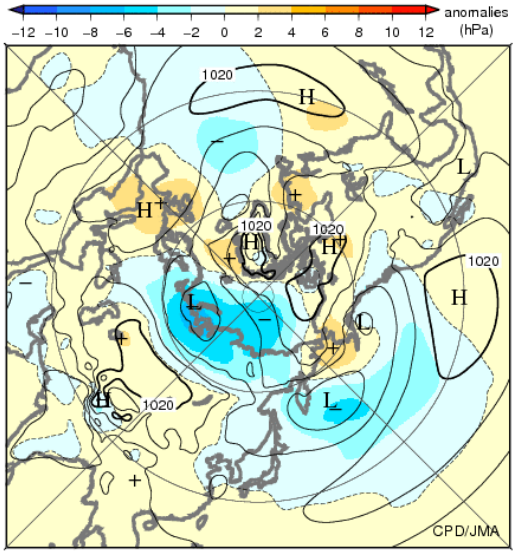

Fig. S8 Three-month mean sea level pressure anomaly in the Northern Hemisphere (March 2017 - May 2017)
The contour interval is 4 hPa. The shading shows anomalies. The base period for the normal is 1981-2010.

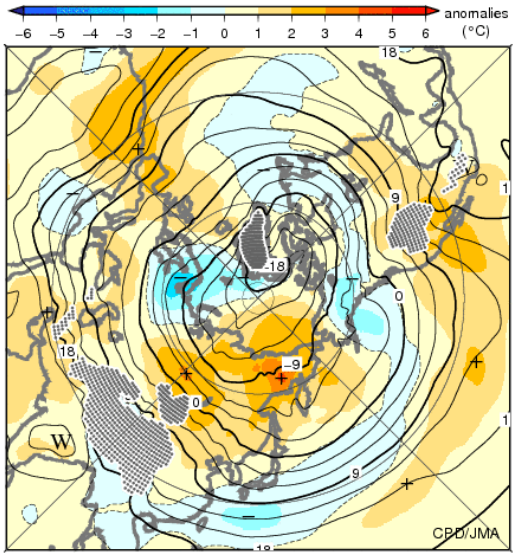

Fig. S9 Three-month mean 850-hPa temperature anomaly in the Northern Hemisphere (March 2017 - May 2017)
The contour interval is 3 degree C. The shading shows anomalies. The base period for the normal is 1981-2010.

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This report is prepared by the Tokyo Climate Center, Climate Prediction Division, Global Environment and Marine Department, Japan Meteorological Agency.