Monthly Highlights on the Climate System (May 2016)

Highlights in May 2016
- The monthly anomaly of the global average surface temperature was the second highest since 1891.
- The El Niño event, which persisted since the boreal summer 2014, is likely to have ended (see *El Niño Outlook* updated on 10 June 2016).
- Convective activity was enhanced over the Indian Ocean and suppressed over the western Pacific.
- The westerly jet stream shifted northward of its normal position over the area from Eurasia to the seas east of Japan.
- Monthly mean temperatures were significantly above normal all over Japan because of warm southerly wind and above normal sunshine duration.

Climate in Japan:

Monthly mean temperatures were significantly above normal all over Japan because of warm southerly wind and above normal sunshine duration. Monthly sunshine durations were above normal from northern Japan to the Sea of Japan side of western Japan and monthly precipitation amounts were below normal in the Pacific side of northern Japan and in eastern Japan due to high pressures around northern Japan in mid- and late May, though high and low pressures alternately passed through around Japan in early May. Monthly precipitation amounts were above normal in the Pacific side of western Japan because of low pressure and front activity intensified by wet southerly wind.

World Climate:

The monthly anomaly of the global average surface temperature in May 2016 (i.e., the combined average of the near-surface air temperature over land and the SST) was +0.37 °C (the second 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 in various places in low latitudes.
- Monthly precipitation amounts were extremely high from northern France to Italy.
- Monthly precipitation amounts were extremely low in eastern Brazil.

Extratropics:

In the 500-hPa height field (Fig. 4), wave trains were seen over the area from northern Eurasia to Japan, with positive anomalies over Western Russia and Japan and negative anomalies over Central Siberia. The westerly jet stream shifted northward of its normal position over the area from Eurasia to the seas east of Japan (Fig. 5). The Pacific High was enhanced in the western part of its climatological extent and southerly warm-air advection around its periphery brought above-normal temperatures over and around Japan. In most part of the troposphere, zonal mean air temperatures were above normal.

Tropics:

Convective activity was enhanced over the Indian Ocean, the central South Pacific and the eastern North Pacific. It was suppressed over the western Pacific and the equatorial Atlantic (Fig. 6). The active phase of the Madden-Julian Oscillation (MJO) was propagating eastward over the area from Africa to the Indian Ocean from early to mid-May (Fig. 7). In the lower troposphere, cyclonic circulation anomalies were seen over the Indian Ocean and anticyclonic circulation anomalies were seen over the western Pacific. In the upper troposphere, cyclonic and anticyclonic circulation anomalies straddling the equator were seen over the western and eastern Pacific, respectively (Fig. 8). The Southern Oscillation Index value was +0.5 (Fig. 10).

Oceanographic Conditions:

Negative SST anomalies were observed in the eastern part of the equatorial Pacific. The monthly mean SST anomaly and the SST deviation from the latest sliding 30-year mean in the NINO.3 region were both +0.1˚C. In the North Pacific, remarkably positive SST anomalies were observed from the South China Sea to near 35˚N, 165˚E, from near the Aleutian Islands through the western coast of North America to near 15˚N, 175˚W, and from the western coast of Central America to near 5˚N, 180˚, and remarkably negative SST anomalies were observed from near 40˚N, 170˚E to near 40˚N, 155˚W. In the South Pacific, remarkably positive SST anomalies were observed from the eastern coast of Australia to northeast of New Zealand, from west of Peru to near 5˚S, 160˚E, and from near 40˚S, 135˚W to near 40˚S, 75˚W. In the Indian Ocean, remarkably positive SST anomalies were observed in the tropical region east of 60˚E. In the North Atlantic, remarkably positive SST anomalies were observed from the eastern coast of North America to near 35˚N, 30˚W, and remarkably negative SST anomalies were observed south of Greenland.

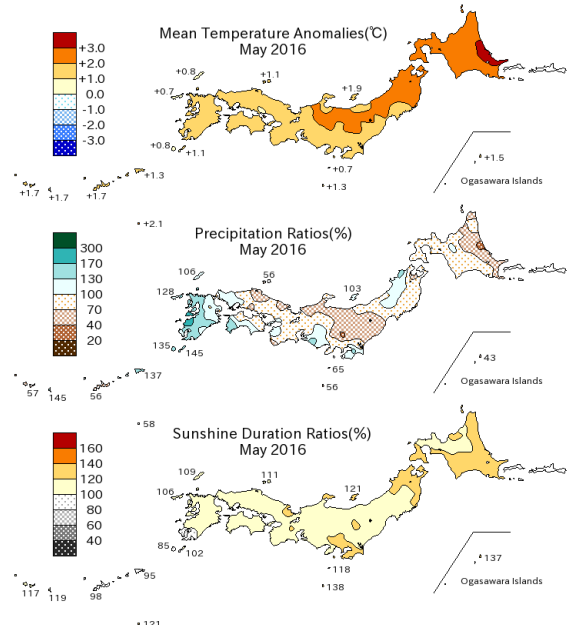

Fig. 1 Monthly climate anomaly / ratio over Japan (May 2016)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
Anomalies are defined as the deviations from the normal (1981-2010 average).

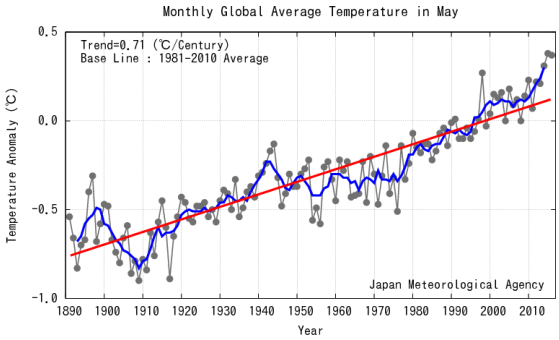

Fig. 2 Long-term change in monthly anomalies of global average surface temperature in May
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations from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

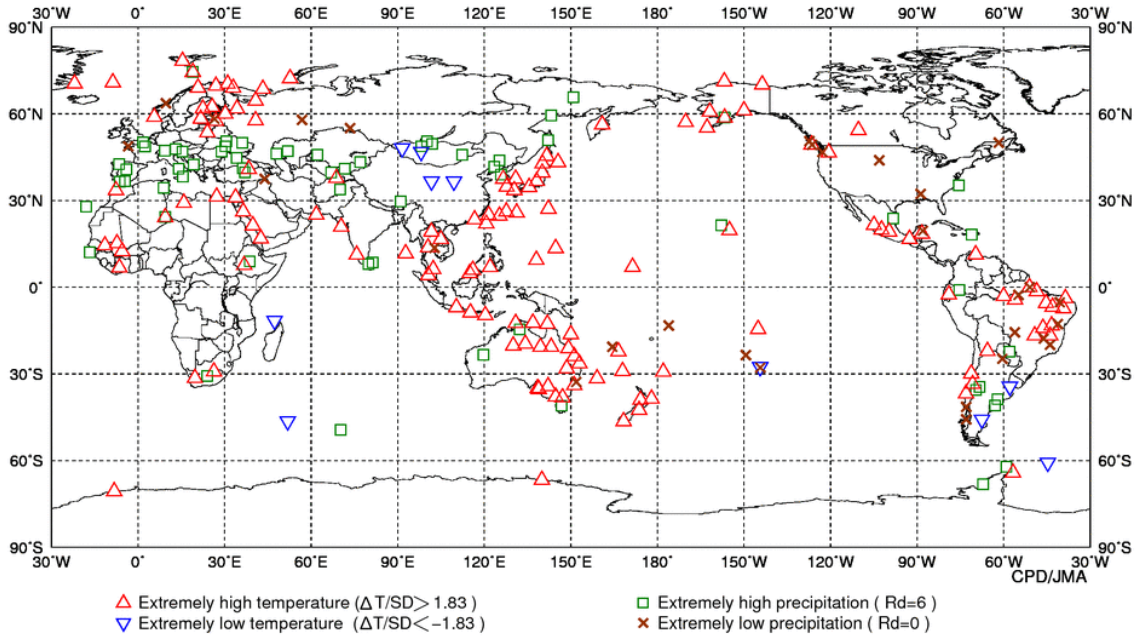

Fig. 3 Distribution of extreme climate events (May 2016)

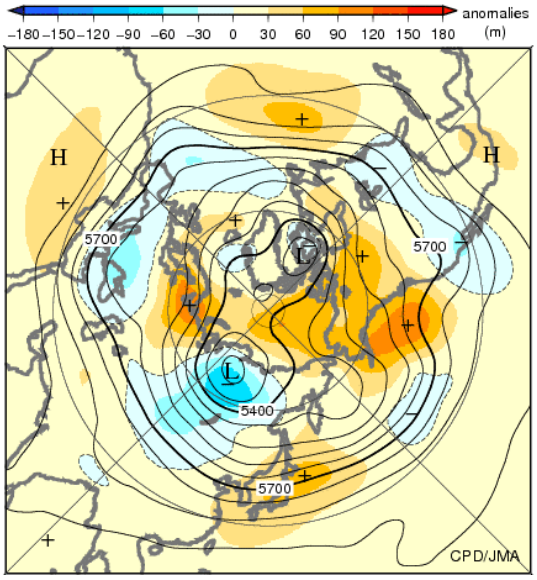

Fig. 4 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (May 2016)

The contours show heights at intervals of 60 m. The shading indicates height anomalies. The base period for the normal is 1981-2010.

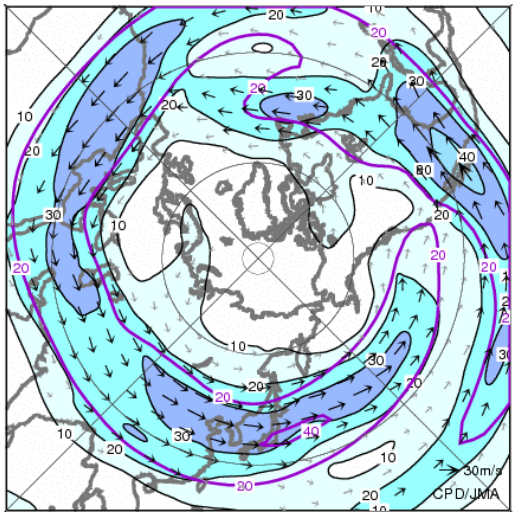

Fig. 5 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (May 2016)

The black lines show wind speeds at intervals of 10 m/s. The purple lines show normal wind speeds at intervals of 20 m/s. The base period for the normal is 1981-2010.

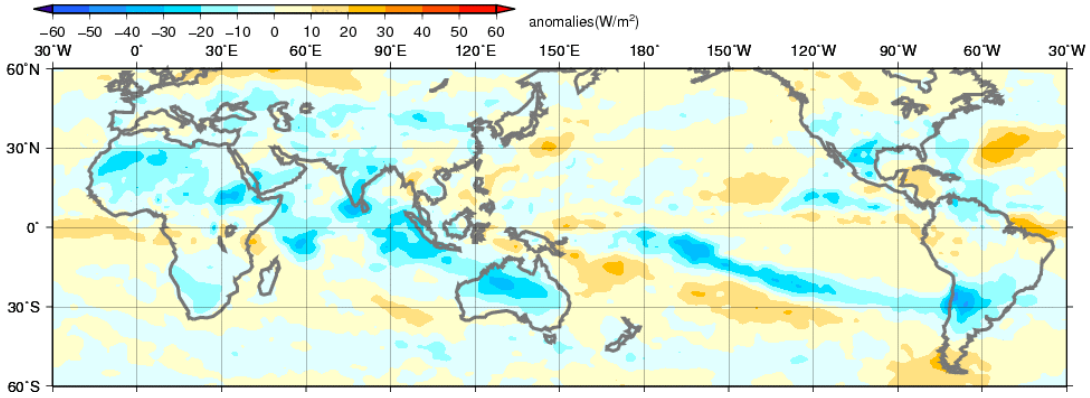

Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (May 2016)

The contour interval is 10 W/m^2. The base period for the normal is 1981-2010. Original data provided by NOAA.

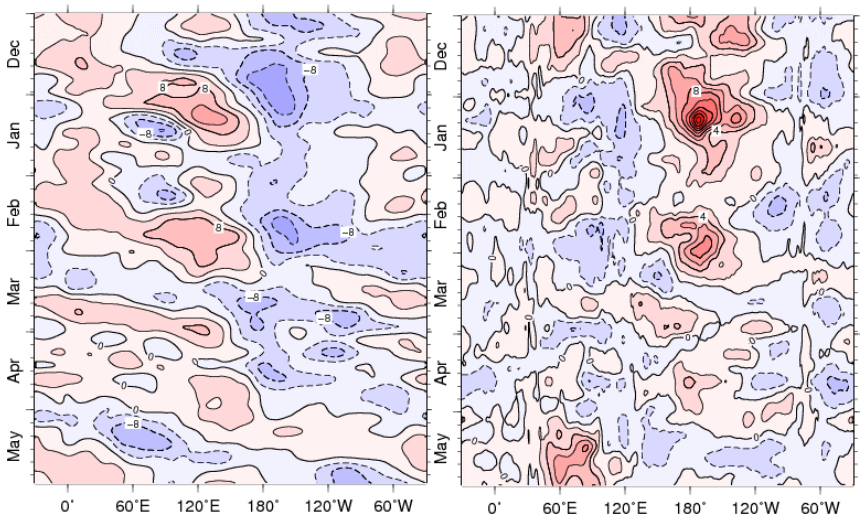

Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (December 2015 – May 2016)

The contour intervals are 4x10^6 m^2/s (left) and 2 m/s (right). The base period for the normal is 1981-2010.

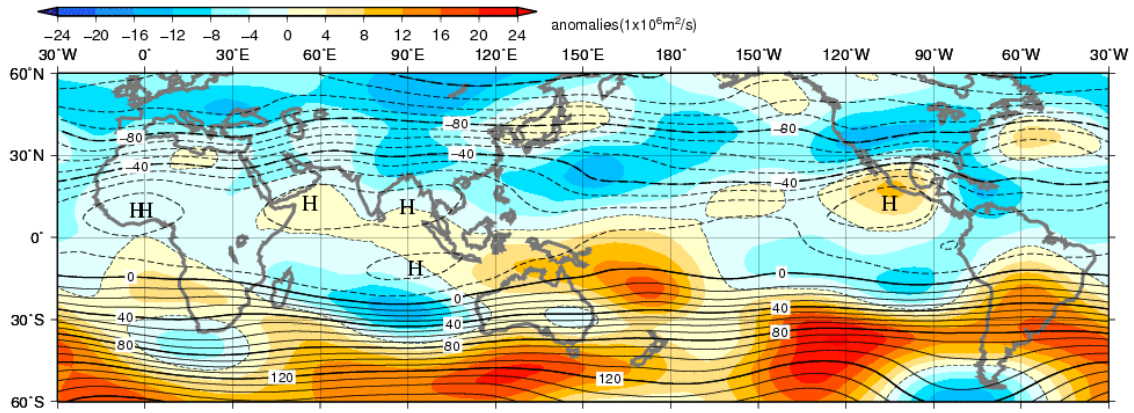

Fig. 8 Monthly mean 200-hPa stream function and anomaly (May 2016)

The contour interval is $10x10^6$ m^2/s. The base period for the normal is 1981-2010.

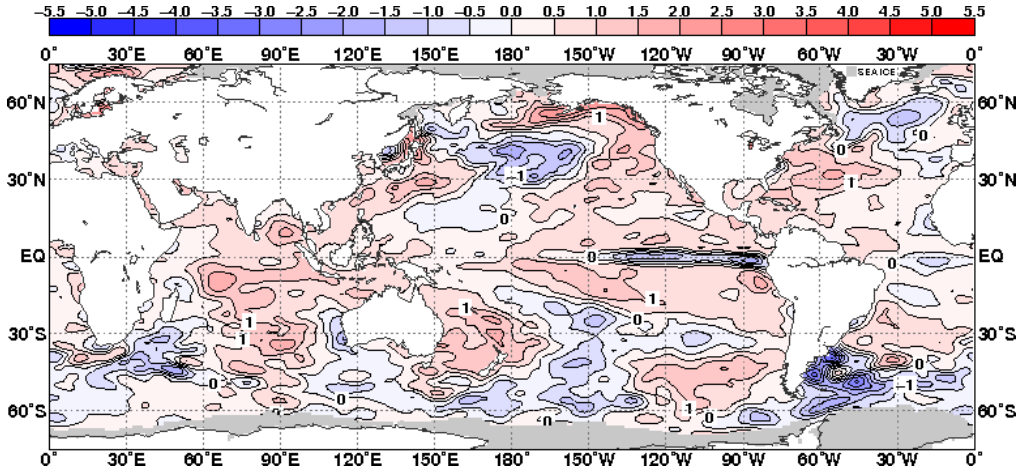

Fig. 9 Monthly mean sea surface temperature anomaly (May 2016)

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.

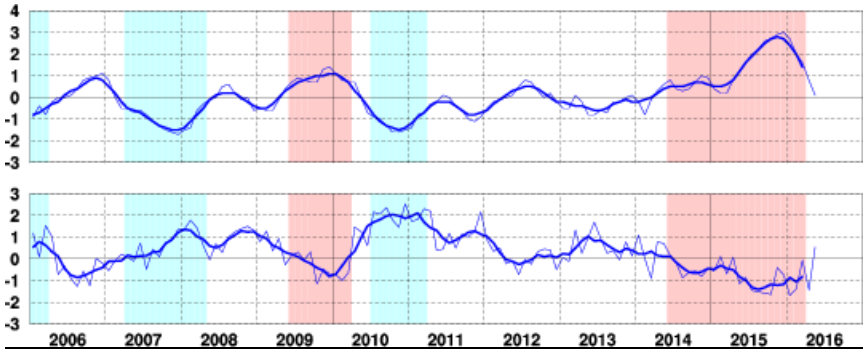

Fig. 10 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1981-2010 base period (lower).

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.

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 Climate Prediction Division, Global Environment and Marine Department, Japan Meteorological Agency.

Seasonal Highlights (March – May 2016)

- Positive SST anomalies were observed in the central equatorial Pacific. In the Indian Ocean, SSTs were above normal basinwide.
- Convective activity was enhanced over the central Pacific and suppressed in the western Pacific.
- In the 500-hPa height field, positive anomalies were observed widely across the Northern Hemisphere, particularly in high latitudes and over and around Japan.
- Seasonal mean temperatures were above normal in many parts of the tropics and mid- to high latitudes of the Northern Hemisphere.
- Seasonal mean temperatures were significantly above normal across Japan. Seasonal sunshine duration was above normal in northern and western Japan, and significantly above normal in the Sea of Japan side of eastern Japan.

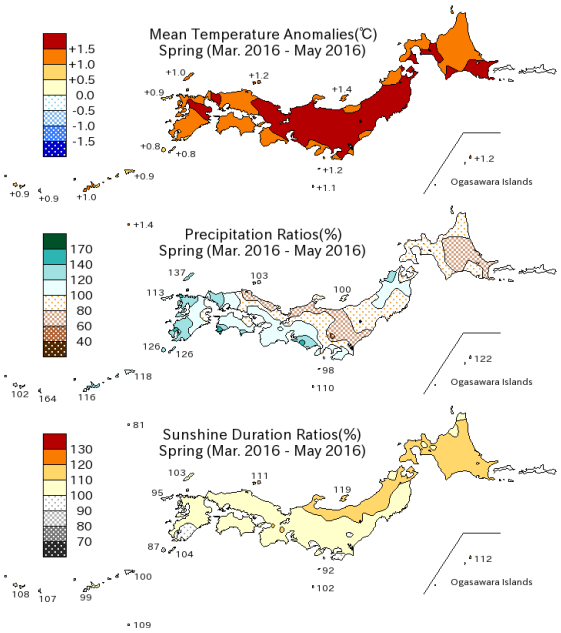

Fig. S1 Seasonal climate anomaly / ratio over Japan (March - May 2016)
Top: Temperature anomalies (degree C)
Middle: Precipitation ratio (%)
Bottom: Sunshine duration ratio (%)
Anomalies are defined as the deviations from the normal (1981-2010 average).

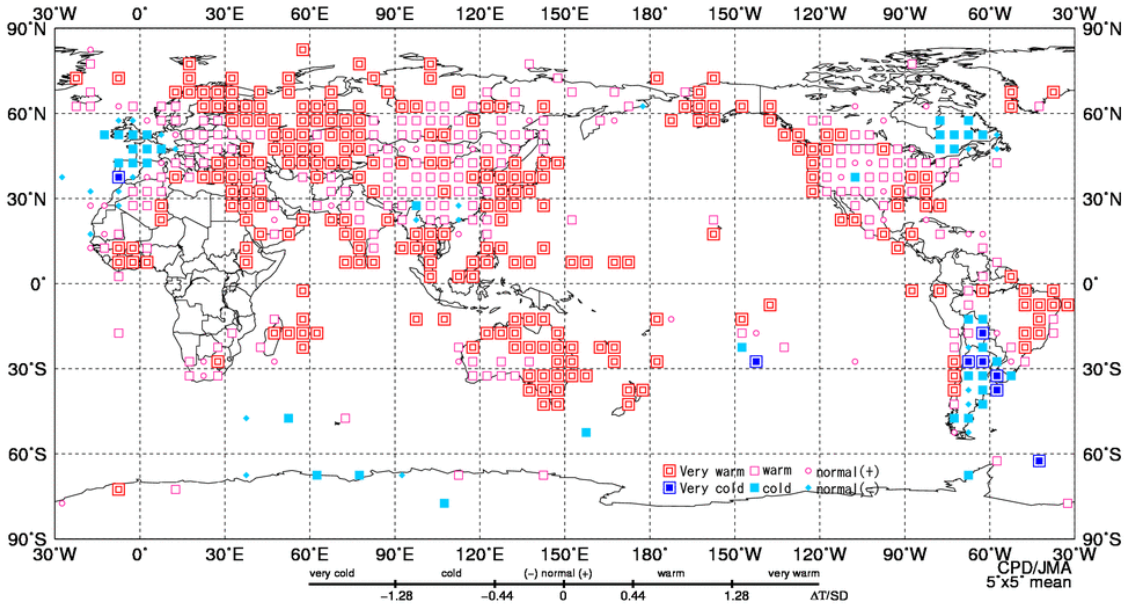

Fig.S2 Three-month mean temperature anomaly (normalized) category (March - May 2016)

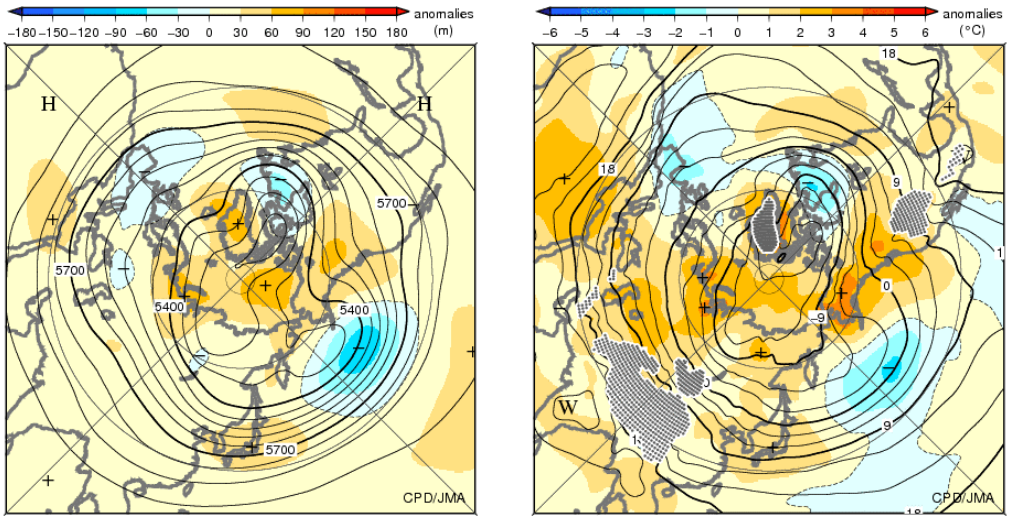

Fig. S3 Three-month mean 500-hPa height and anomaly (left) and 850-hPa temperature and anomaly (right) in the Northern Hemisphere (March - May 2016)

The contour intervals are 60 m (left) and 3 degree C (right). The shading shows anomalies. The base period for the normal is 1981-2010.

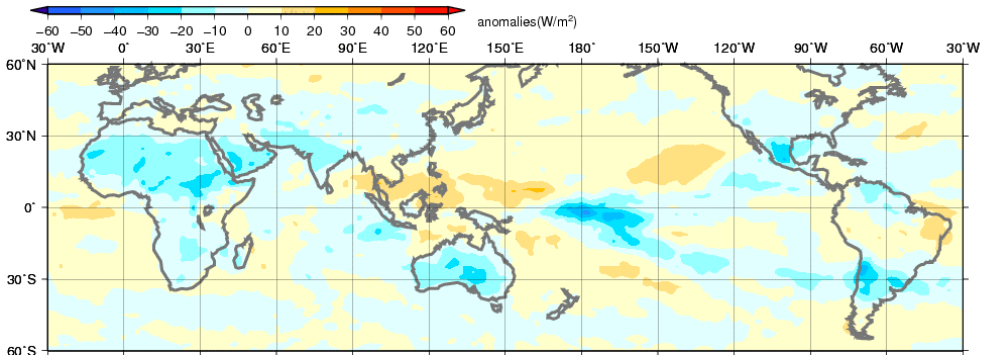

Fig. S4 Three-month mean Outgoing Longwave Radiation (OLR) anomaly (March - May 2016)

The contour interval is 10 W/m^2. The base period for the normal is 1981-2010. Original data provided by NOAA.

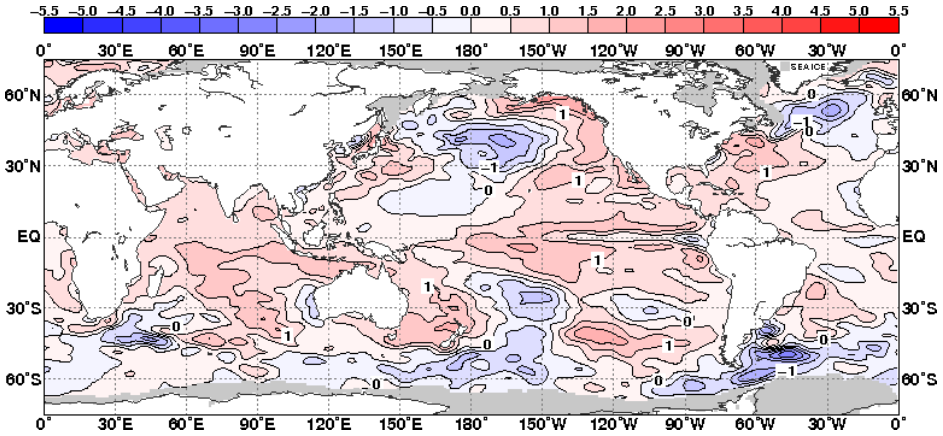

Fig. S5 Three-month mean sea surface temperature anomaly (March - May 2016)

The contour interval is 0.5 degree C. The base period for the normal is 1981-2010.

Detailed seasonal information on the climate system is available on the Tokyo Climate Center's website.
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