Monthly Highlights on the Climate System (March 2017)

Highlights in March 2017
- The monthly anomaly of the global average surface temperature was the second warmest since 1891.
- In the equatorial Pacific, positive SST anomalies were dominant except around the date line.
- Convective activity was enhanced from the Maritime Continent to the east of the Philippines.
- A blocking high developed from Eastern Siberia to the Bering Sea, and a trough was observed to the east of Japan.
- Monthly precipitation amounts were below normal almost all over Japan.

Climate in Japan:

Monthly sunshine durations were above normal and monthly precipitation amounts were below normal almost all over Japan since high pressure systems frequently covered the main island and low pressure systems were inactive in the vicinity of Japan.

Monthly mean temperatures were below normal in western Japan and Okinawa/Amami, while those were above normal in northern Japan, since cold air from the continent flowed mainly into the western part of Japan due to blocking highs over eastern Siberia.

World Climate:

The monthly anomaly of the global average surface temperature in March 2017 (i.e., the combined average of the near-surface air temperature over land and the SST) was +0.48 °C (2nd warmest since 1891) (preliminary value) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.86°C per century in March (preliminary value).

Extreme climate events were as follows (Fig. 3).
- Monthly mean temperatures were extremely high from northern Siberia to northwestern Russia.
- Monthly precipitation amounts were extremely high in and around the northwestern USA and monthly mean temperatures were extremely high from the central USA to northwestern Mexico.
- Monthly mean temperatures were extremely high from northern to southeastern Australia.

Extratropics:

In the 500-hPa height field (Fig. 4), the polar vortex was stronger than normal. A blocking high developed from Eastern Siberia to the Bering Sea in the first half of the month, and positive anomalies extended zonally from Siberia to the Bering Sea. On the other hand, negative anomalies were seen from China to the seas east of Japan. In association with the meridional dipole anomaly pattern, the subtropical jet stream was displaced southward of its normal position from around Japan to the seas east of Japan (Fig. 5). The Siberian High was stronger than normal around the Lake Baikal. The Aleutian Low was stronger than normal over the southwestern part of its normal extent. Temperatures at 850-hPa were above normal over Siberia and below normal around Japan. Europe and the western USA were also warmer than normal, reflecting the positive anomalies of the 500-hPa height. The zonal mean westerly jet streams tended to be divided into two branches over the Northern Hemisphere. Zonal mean temperatures in the troposphere were above normal over the northern high latitudes.

Tropics:

Convective activity was enhanced from the Maritime Continent to the east of the Philippines, from the eastern South Pacific to northern South America and over the South Indian Ocean. It was suppressed from near the date line to the eastern North Pacific (Fig. 6). The active phase of the Madden-Julian Oscillation (MJO) propagated from eastern Indian Ocean to the Maritime Continent in the first half of March (Fig. 7). In the upper troposphere, anti-cyclonic circulation anomalies straddling the equator were seen from the Indian Ocean to the western Pacific, especially in the western Pacific (Fig. 8). In the lower troposphere, cyclonic and anti-cyclonic circulation anomalies straddling the equator were seen near the Maritime Continent and over the Pacific, respectively, and easterly wind anomalies were dominant along the equator to the west of the date line (Fig. 7). The Southern Oscillation Index value was +0.8 (Fig. 10).

Oceanographic Conditions:

In the equatorial Pacific, positive SST anomalies were dominant except around the date line. 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.

In the North Pacific, remarkably positive SST anomalies were widely observed from near 10˚N, 130˚E to the western coast of Central America. In the South Pacific, remarkably positive SST anomalies were observed in almost the entire region from the eastern coast of Australia to the coast of Peru and northern part of Chile except near 20˚S, 180˚.

In the Indian Ocean, remarkably positive SST anomalies were observed from around Madagascar to near 30˚S, 95˚E, and remarkably negative SST anomalies were observed from near 15˚S, 80˚E to the western coast of Australia.

In the North Atlantic, remarkably positive SST anomalies were observed from near 40˚N, 75˚W to near 35˚N, 20˚W.

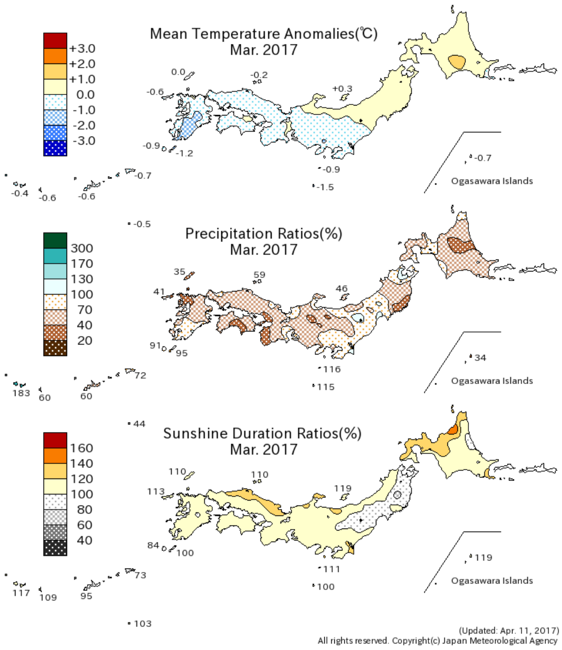

Fig. 1 Monthly climate anomaly / ratio over Japan (March 2017)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
Anomalies are defined as the deviations from the normal (1981-2010 average).

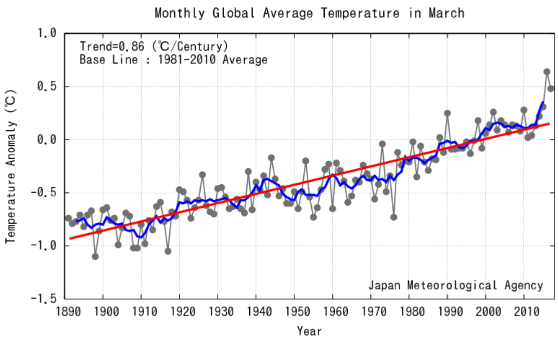

Fig. 2 Long-term change in monthly anomalies of global average surface temperature in March
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations from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

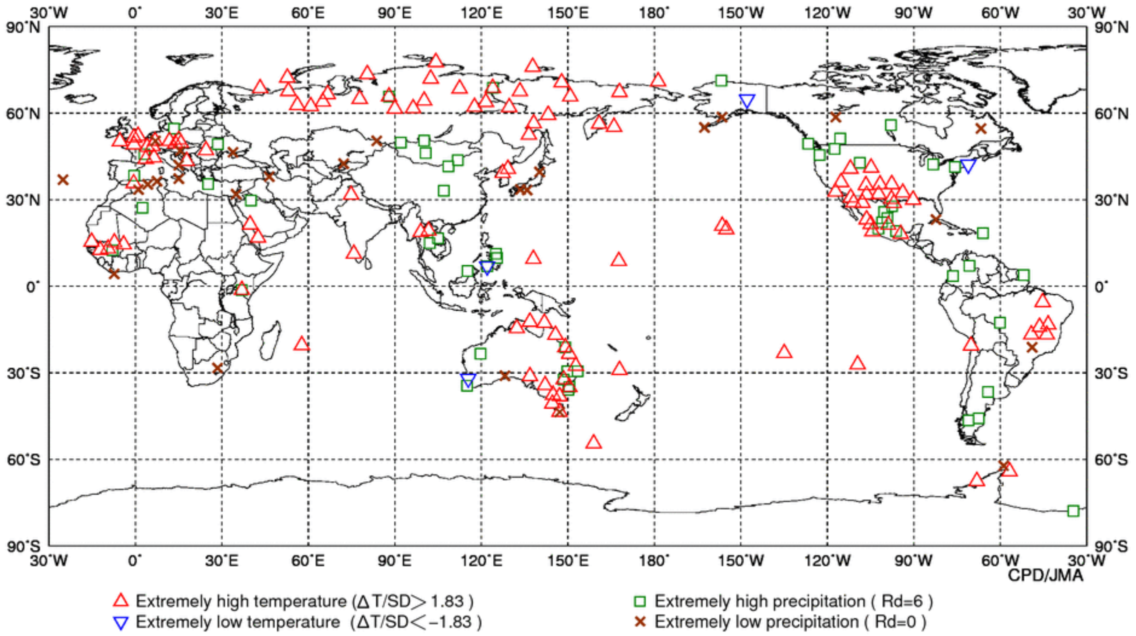

Fig. 3 Distribution of extreme climate events (March 2017)

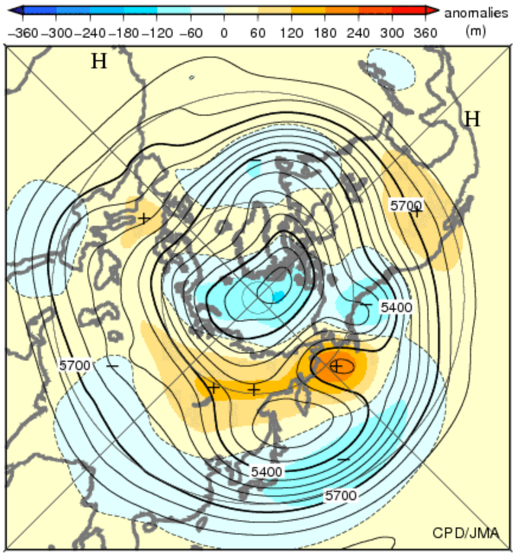

Fig. 4 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (March 2017)

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

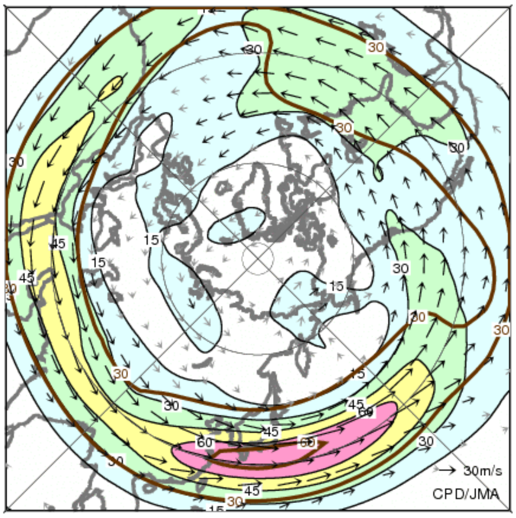

Fig. 5 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (March 2017)

The black lines show wind speeds at intervals of 15 m/s. The brown lines show normal wind speeds at intervals of 30 m/s. The base period for the normal is 1981-2010.

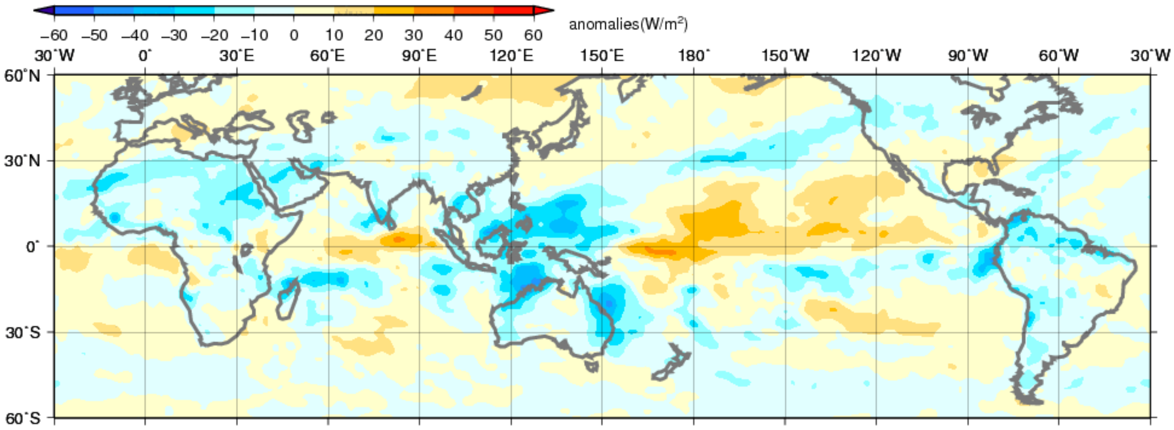

Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (March 2017)

The contour interval is 10 W/m². The base period for the normal is 1981-2010. Original data provided by NOAA.

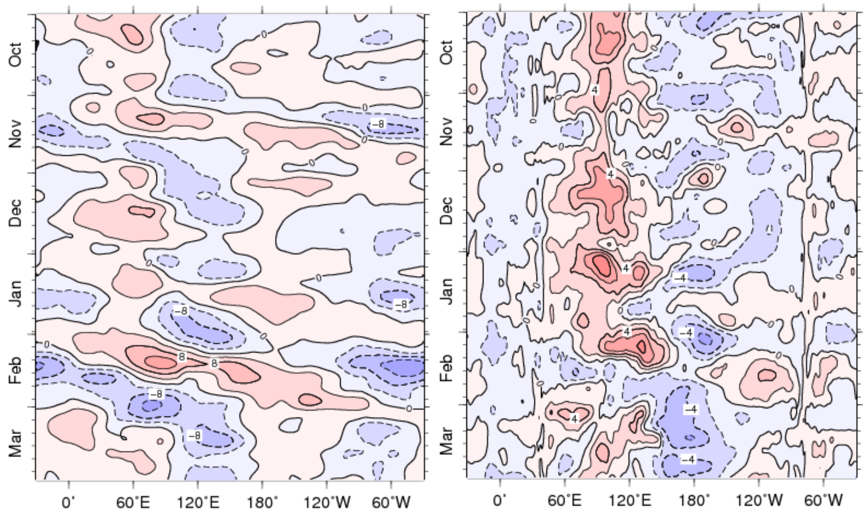

Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (October 2016 – March 2017)

The contour intervals are 4×10^6 m²/s (left) and 2 m/s (right). The base period for the normal is 1981-2010.

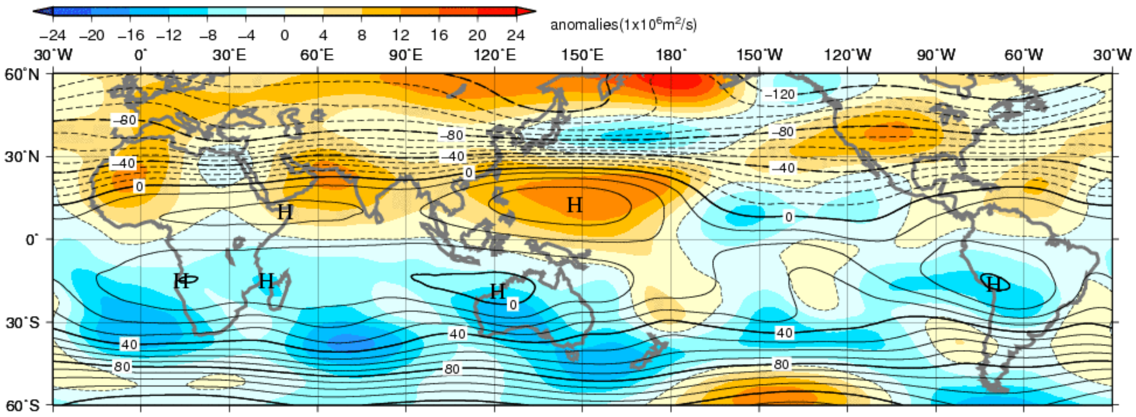

Fig. 8 Monthly mean 200-hPa stream function and anomaly (March 2017)

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

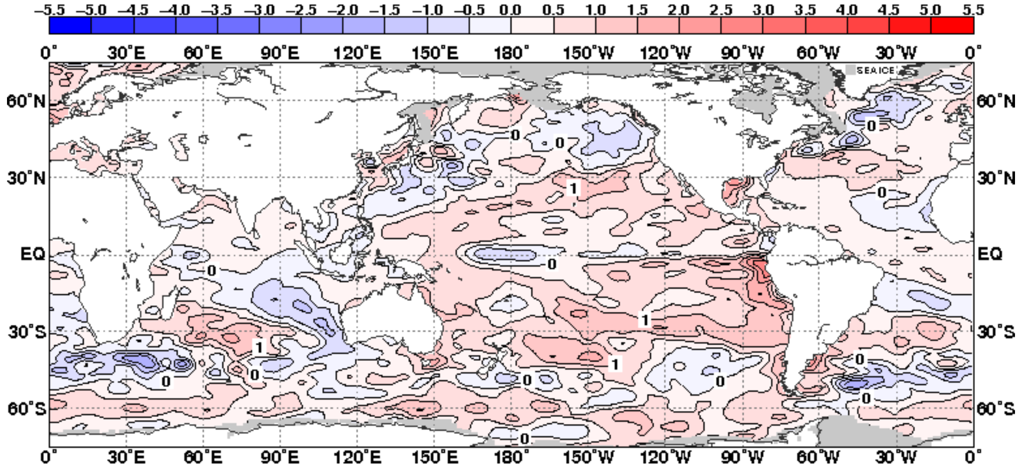

Fig. 9 Monthly mean sea surface temperature anomaly (March 2017)

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.

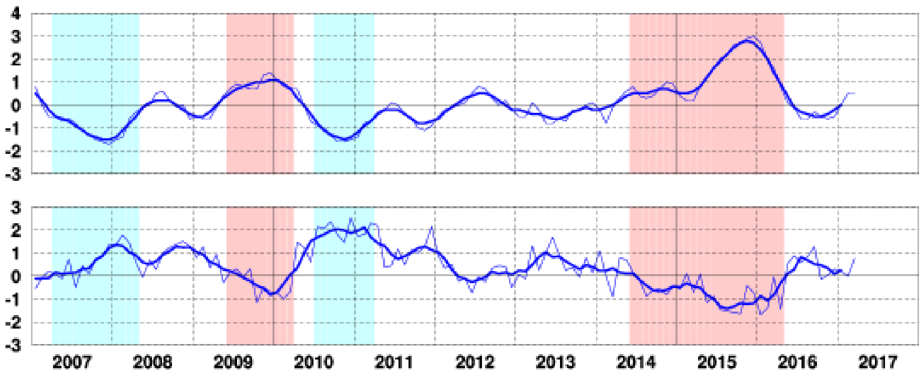

Fig. 10 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1981-2010 base period (lower).

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.