# Monthly Highlights on the Climate System (April 2016)

Highlights in April 2016
- The monthly anomaly of the global average surface temperature was the warmest since 1891.
- The El Niño conditions, which have persisted since the Northern Hemisphere summer 2014, are decaying (see *El Niño Outlook* updated on 12 May 2016).
- Convective activity was enhanced over the equatorial central Pacific, and was suppressed from the Bay of Bengal to the tropical western North Pacific.
- The westerly jet stream shifted northward of its normal position over and to the east of Japan.
- Both monthly mean temperatures and monthly precipitation amounts were above normal all over Japan.

## Climate in Japan:

High and low pressures alternately passed through around Japan, but low pressures frequently passed mainly along the southern coast of Japan in early and late April. Warm and wet southerly wind tented to flow into Japan throughout the month due to the strong high pressure in the southeast of Japan. Therefore, both monthly mean temperatures and monthly precipitation amounts were above normal all over Japan. Warm days continued and monthly mean temperatures were significantly above normal in eastern and western Japan and in Okinawa/Amami. Monthly sunshine durations were below normal in the Pacific side of eastern Japan and in western Japan.

## World Climate:

The monthly anomaly of the global average surface temperature in April 2016 (i.e., the combined average of the near-surface air temperature over land and the SST) was +0.54°C (the warmest since 1891) (preliminary value) (Fig. 2). On a longer time scale, global average surface temperatures have risen at a rate of about 0.76°C per century in April (preliminary value).

Extreme climate events were as follows (Fig. 3).

- Monthly mean temperatures were extremely high in various places in the low latitudes.
- Monthly precipitation amounts were extremely high from the Midwest of the USA to the southern USA.
- Monthly mean temperatures were extremely low in eastern Canada.

## Extratropics:

In the 500-hPa height field (Fig. 4), positive anomalies were seen over western North America, Greenland, Western to Central Siberia and Japan except its northern part, and negative anomalies were seen over the northern part of the North Pacific, eastern Canada and northwestern Europe. The westerly jet stream shifted northward of its normal position over and to the east of Japan (Fig. 5). In the sea level pressure field, the southwestward extension of the Pacific High was stronger than normal and negative anomalies were seen over Eurasia. In the troposphere, zonal mean temperatures were above normal.

## Tropics:

Convective activity was enhanced over the equatorial central Pacific, and was suppressed from the Bay of Bengal to the tropical western North Pacific (Fig. 6). The active phase of the Madden-Julian Oscillation (MJO) was obscure (Fig. 7). In the lower troposphere, cyclonic circulation anomalies were seen over the central Pacific. Westerly wind anomalies were seen in latitudes just south of the equator in the central Pacific (Fig. 7). In the upper troposphere, anticyclonic circulation anomalies straddling the equator were seen over the central Pacific (Fig. 8). The Southern Oscillation Index value was -1.4 (Fig. 10).

## Oceanographic Conditions:

In the equatorial Pacific, remarkably positive SST anomalies were observed in the central part, and negative SST anomalies were observed in some parts of the eastern part. The monthly mean SST anomaly and the SST deviation from the latest sliding 30-year mean in the NINO.3 region were both +0.8˚C.

In the North Pacific, remarkably positive SST anomalies were observed from near the Philippines to east of Japan, from the western coast of North America to near 20˚N, 165˚W, and in the eastern tropical region, and remarkably negative SST anomalies were observed from near 10˚N, 150˚E to near 20˚N, 170˚E, and from south of the Aleutian Islands to near 40˚N, 145˚W. In the South Pacific, remarkably positive SST anomalies were observed near the eastern coast of Australia, from near 10˚S, 175˚E to near 15˚S, 80˚W, and from near 40˚S, 145˚W to near 45˚S, 85˚W, and remarkably negative SST anomalies were observed from near 20˚S, 180˚ to near 35˚S, 150˚W.

In the Indian Ocean, remarkably positive SST anomalies were observed in almost the entire area of the tropical region.

In the North Atlantic, remarkably positive SST anomalies were observed from the eastern coast of North America to near 35˚N, 35˚W, and remarkably negative SST anomalies were observed south of Greenland.

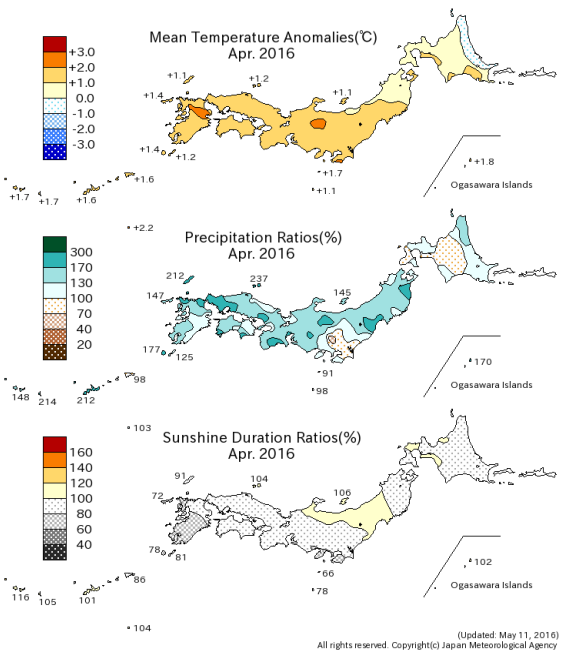


Fig. 1 Monthly climate anomaly / ratio over Japan (April 2016)

Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
Anomalies are defined as the deviations from the normal (1981-2010 average).

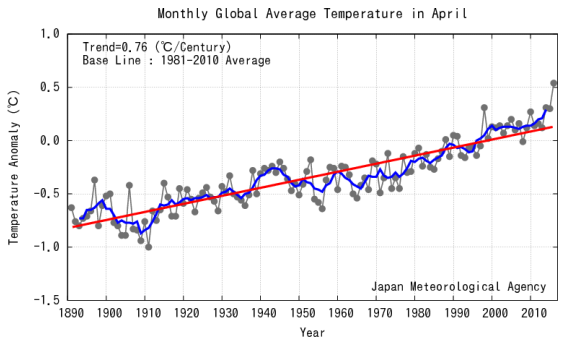


Fig. 2 Long-term change in monthly anomalies of global average surface temperature for April

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.

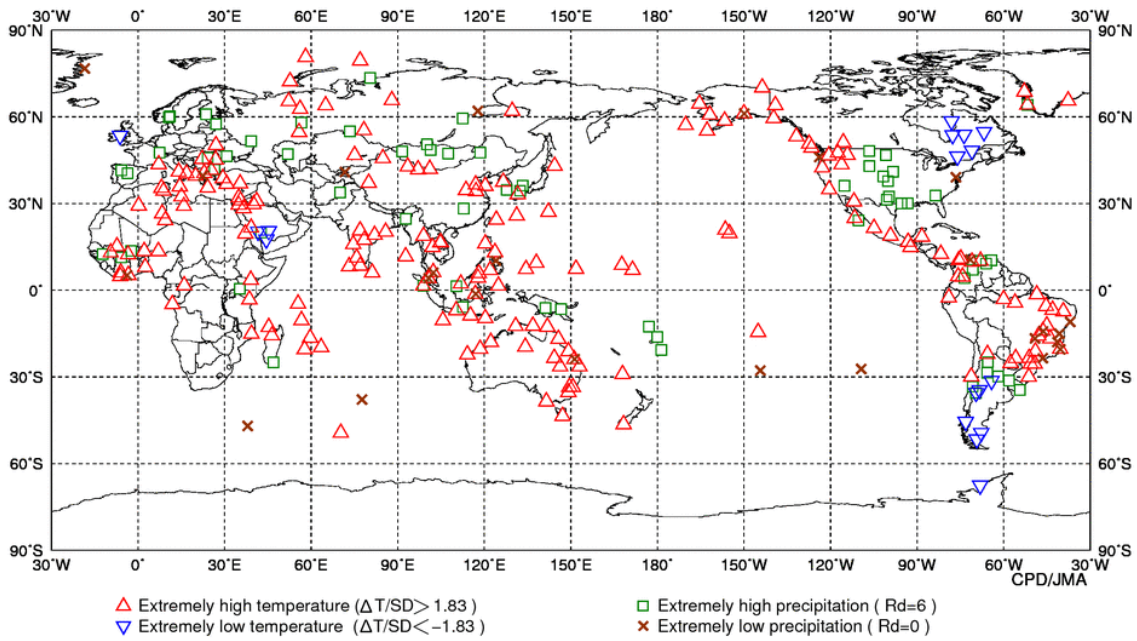


Fig. 3 Distribution of extreme climate events (April 2016)

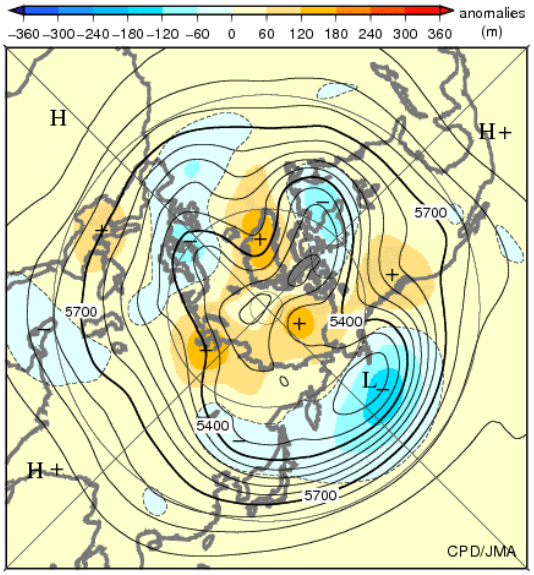


Fig. 4 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (April 2016)

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

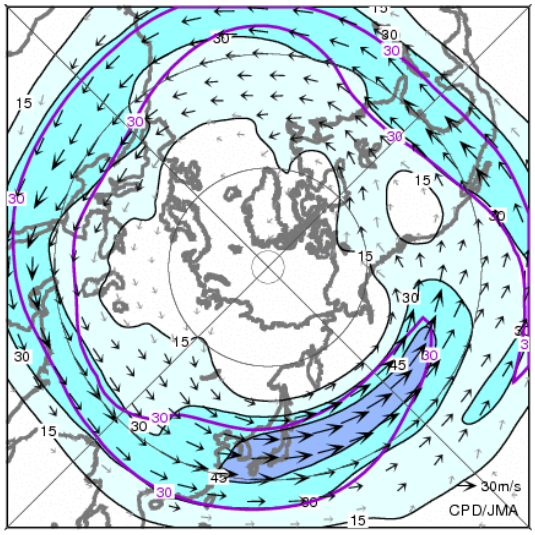


Fig. 5 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (April 2016)

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

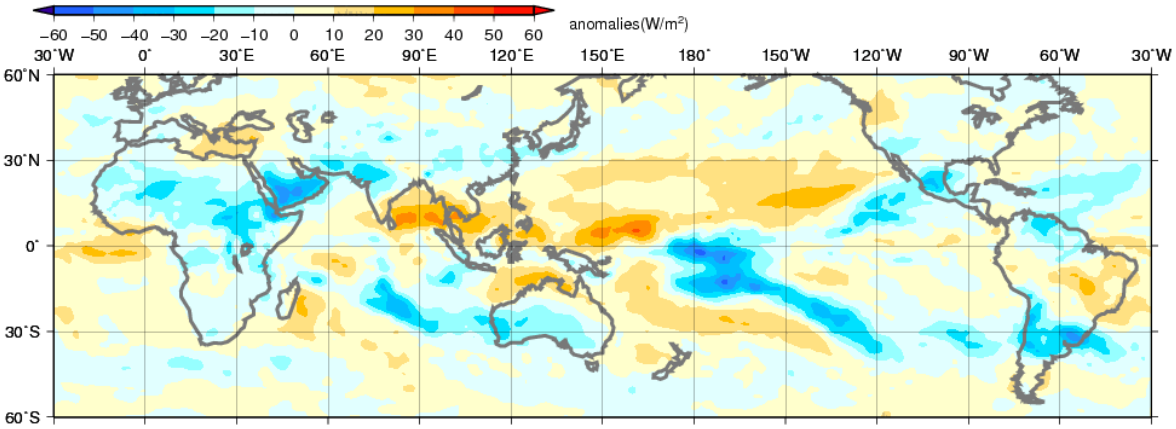


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (April 2016)

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

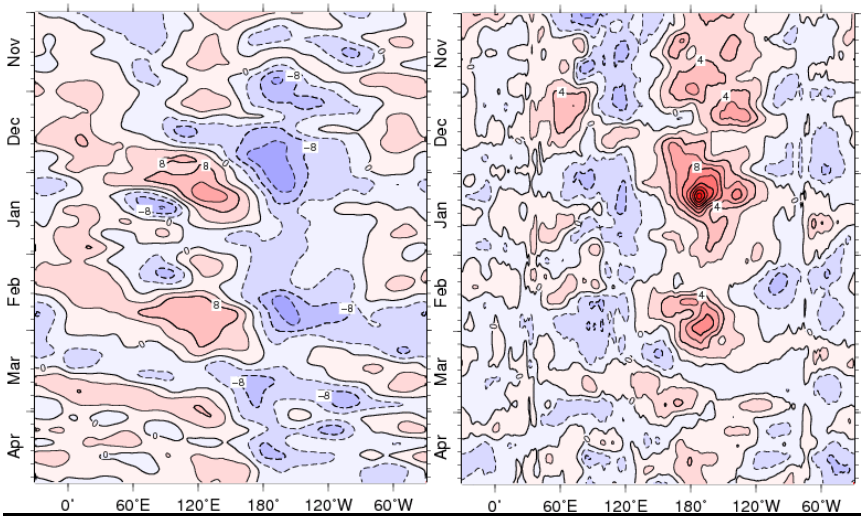


Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (November 2015–April 2016)

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

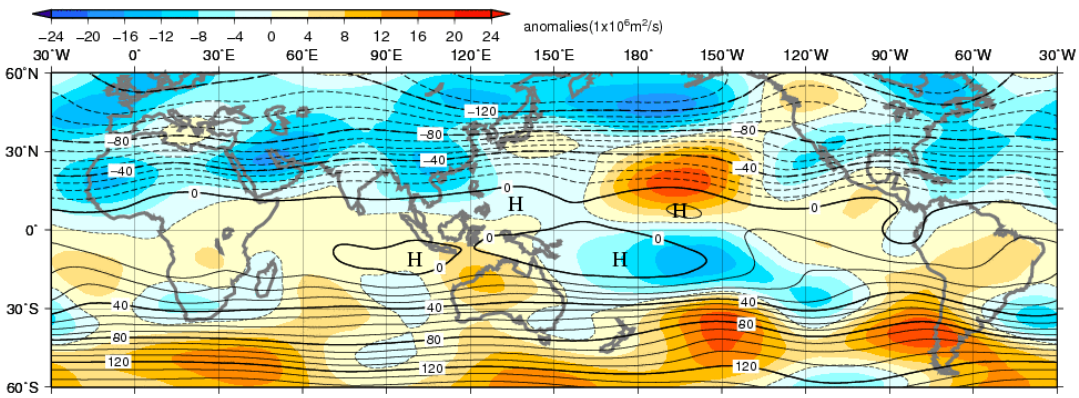


Fig. 8 Monthly mean 200-hPa stream function and anomaly (April 2016)

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

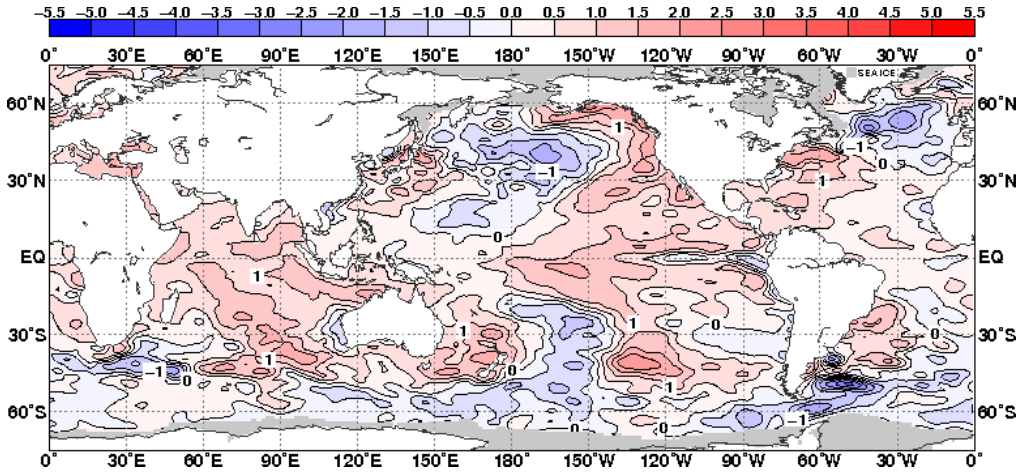


Fig. 9 Monthly mean sea surface temperature anomaly (April 2016)

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.

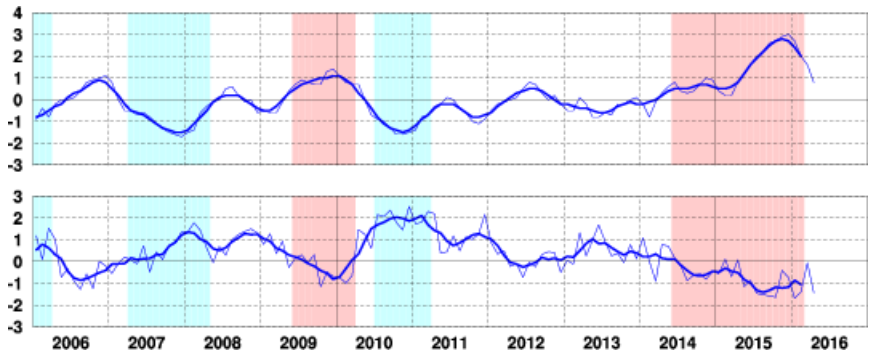


Fig. 10 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1981-2010 base period (lower).

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.