

## Monthly Highlights on the Climate System (November 2015)

### Highlights in November 2015

- The monthly anomaly of the global average surface temperature was the warmest since 1891.
- El Niño event, which emerged in the Northern Hemisphere summer 2014, is in its mature stage. (see [El Niño Outlook](#) updated on 10 December 2015).
- The characteristics of the convective activity and circulation in tropics were similar to those observed in the past El Niño events.
- The polar jet stream was clearly seen and slightly shifted northward in and around East Asia.
- Monthly mean temperatures were significantly above normal in eastern and western Japan and Okinawa/Amami, and were the highest on record for November since 1946 in Okinawa/Amami.

### Climate in Japan:

High and low pressures alternately passed through around Japan, and the northwestern monsoon was weaker than normal. Cloudy or rainy weather continued, since low pressures frequently passed around western Japan. Therefore, there were much precipitation and less sunshine durations in western Japan and the Pacific side of northern and eastern Japan. In particular, monthly sunshine durations were the lowest on record for November since 1946 in the Pacific side of western Japan. Weak cold surges brought warmer-than-normal days to the whole of Japan. Monthly mean temperatures were significantly above normal in eastern and western Japan and Okinawa/Amami, and were the highest on record for November since 1946 in Okinawa/Amami.

### World Climate:

The monthly anomaly of the global average surface temperature in November 2015 (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 0.71°C per century in November (preliminary value).

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

- Monthly mean temperatures were extremely high in various places in the low latitudes.
- Monthly mean temperatures were extremely high in and around western Europe.
- Monthly mean temperatures were extremely high and monthly precipitation amounts were extremely light in and around western Indonesia.

### Extratropics:

In the 500-hPa height field (Fig.4), significant positive anomalies were observed over Central Siberia. Positive anomalies were seen from East Asia to the eastern Pacific, the eastern USA and the eastern Atlantic Ocean to Europe, and negative anomalies were observed over the northern

Atlantic and around the Bering Sea. The polar jet stream was clearly seen and slightly shifted northward in and around East Asia (Fig. 5).

### Tropics:

Convective activity was enhanced over the northern Indian Ocean and the equatorial central Pacific, and was suppressed over the Philippines and the Maritime Continent (Fig. 6). The active phase of the Madden-Julian Oscillation (MJO) was seen propagating eastward from the Indian Ocean to the Maritime Continent in early November, and from the Maritime Continent to the central Pacific in late November albeit with weaker amplitude (Fig. 7). In the lower troposphere, cyclonic and anti-cyclonic circulation anomalies straddling the equator were seen over the Pacific and over the Maritime Continent, respectively. In the upper troposphere, anticyclonic circulation anomalies straddling the equator were seen from Africa to the Indian Ocean and from the central to eastern Pacific (Fig. 8). The Southern Oscillation Index value was -0.4 (Fig. 10).

### Oceanographic Conditions:

Remarkably positive SST anomalies were observed from near the date line to the eastern part of the equatorial Pacific. The monthly mean SST anomaly in the NINO.3 region and the SST deviation from the latest sliding 30-year mean were both +2.9°C. In the North Pacific, remarkably positive SST anomalies were observed from near the Aleutian Islands to south of Alaska, from the western coast of North America to central and eastern parts of the tropical region, and from south of Japan to the South China Sea. In the South Pacific, remarkably positive SST anomalies were observed from near 45°S, 150°W to near 50°S, 100°W. In the Indian Ocean, remarkably positive SST anomalies were observed in almost the entire region. In the North Atlantic, remarkably positive SST anomalies were observed near the eastern coast of North America and from the Gulf of Mexico to near 30°N, 35°W, and remarkably negative SST anomalies were observed south of Greenland.

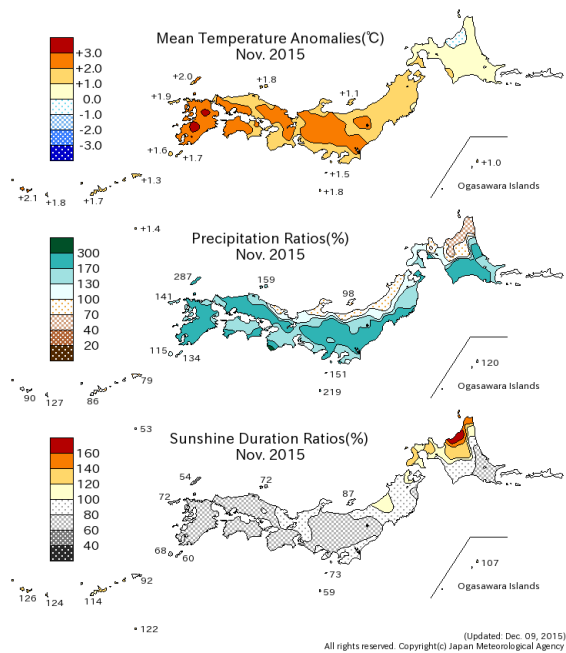


Fig. 1 Monthly climate anomaly / ratio over Japan (November 2015)  
 Top: temperature anomalies (degree C)  
 Middle: precipitation ratio (%)  
 Bottom: sunshine duration ratio (%)  
 Anomalies are defined as the deviations from the normal (1981-2010 average).

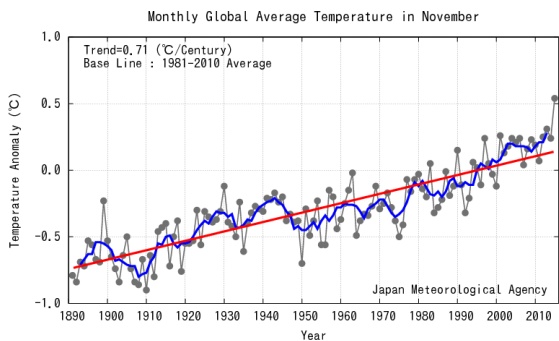


Fig. 2 Long-term change in monthly anomalies of global average surface temperature in November  
 The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations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

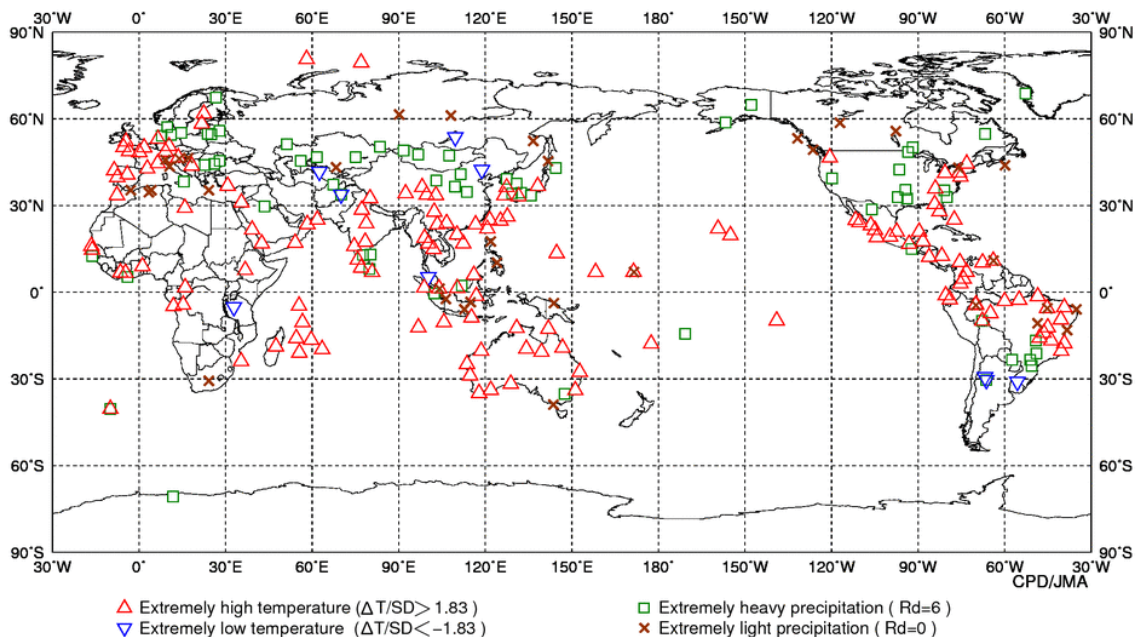


Fig. 3 Distribution of extreme climate events (November 2015)

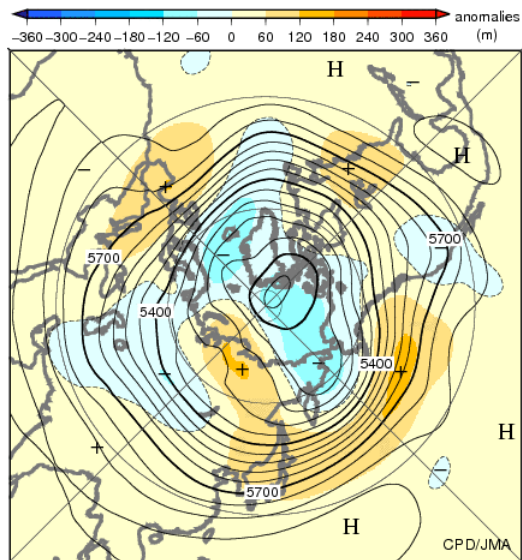


Fig. 4 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (November 2015)  
The contours show heights at intervals of 60 m. The shading indicates height anomalies. The base period for the normal is 1981-2010.

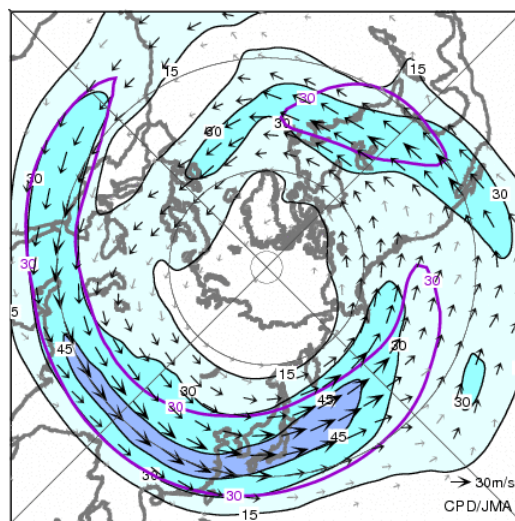


Fig. 5 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (November 2015)  
The black lines show wind speeds at intervals of 15 m/s. The purple lines show normal wind speeds at intervals of 30 m/s. The base period for the normal is 1981-2010.

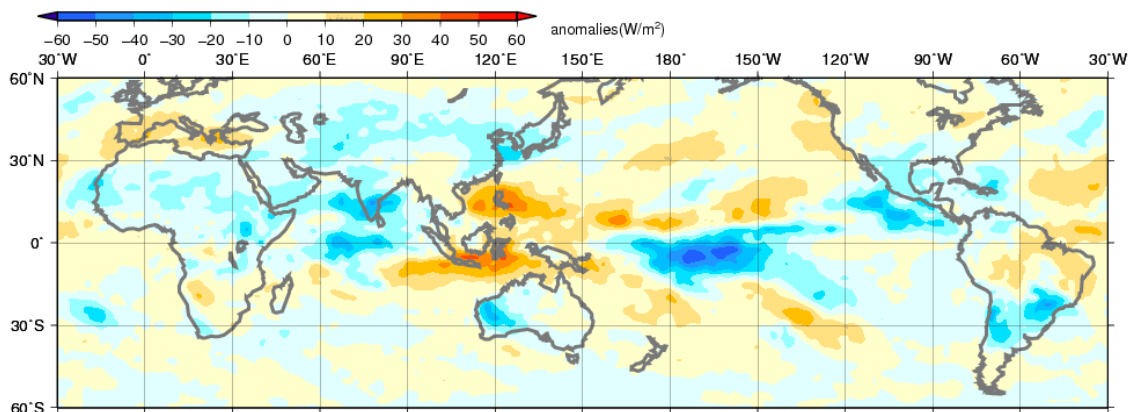


Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (November 2015)  
The contour interval is 10 W/m<sup>2</sup>. The base period for the normal is 1981-2010. Original data provided by NOAA.

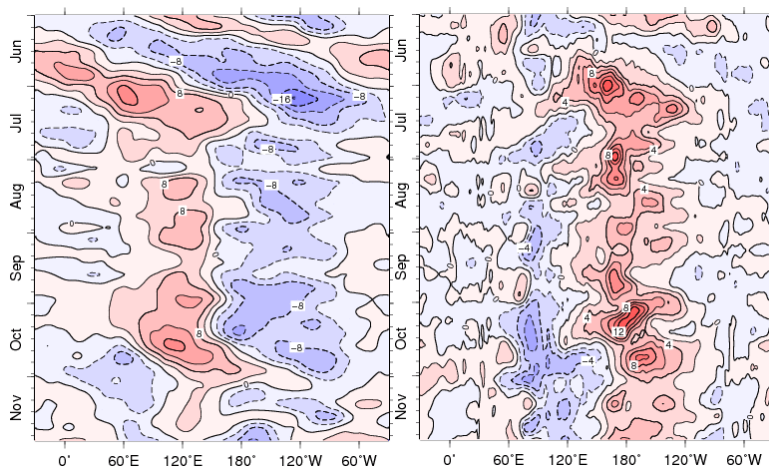


Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (June 2015 – November 2015)  
The contour intervals are  $4 \times 10^6$  m<sup>2</sup>/s<sup>2</sup> (left) and 2 m/s (right). The base period for the normal is 1981-2010.



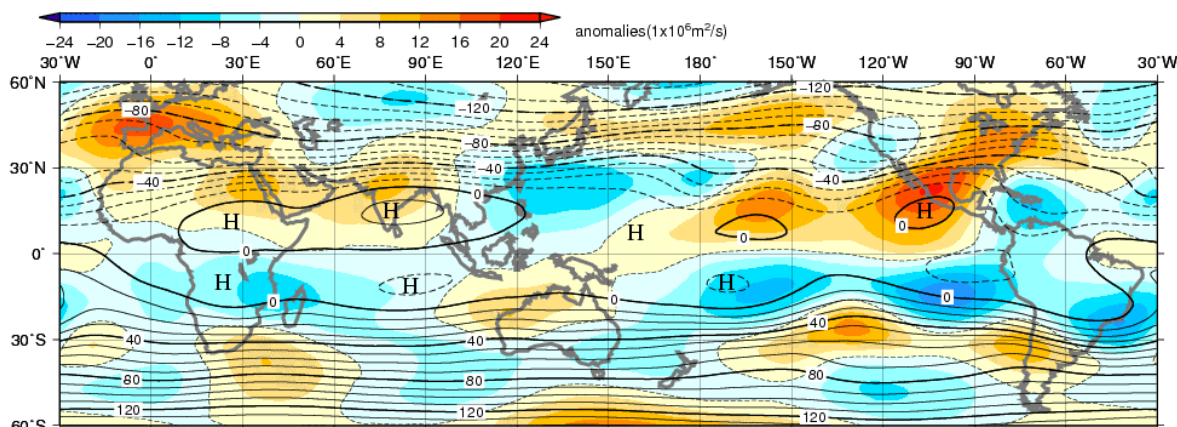


Fig. 8 Monthly mean 200-hPa stream function and anomaly (November 2015)  
The contour interval is  $10 \times 10^6 \text{ m}^2/\text{s}$ . The base period for the normal is 1981-2010.

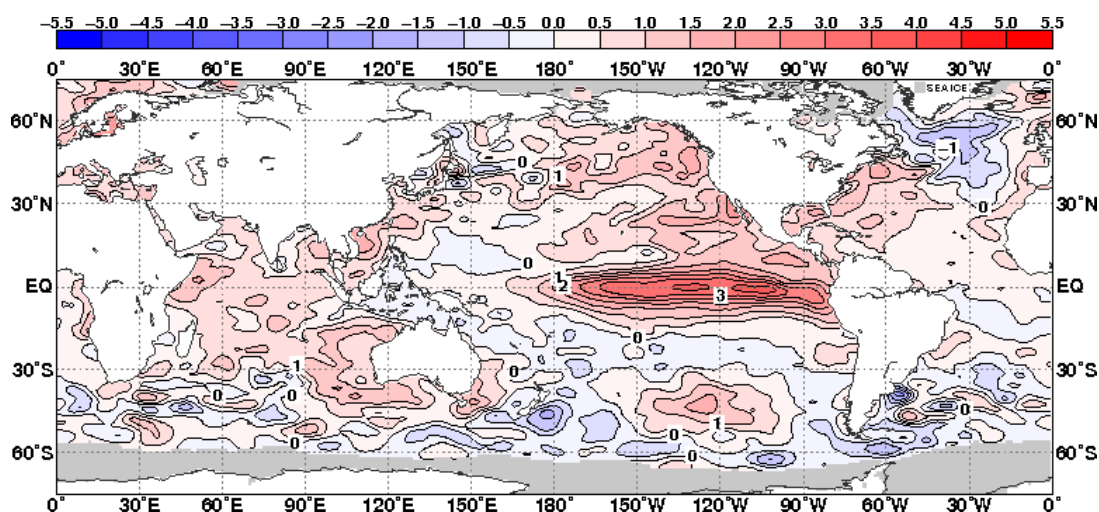


Fig. 9 Monthly mean sea surface temperature anomaly (November 2015)  
The contour interval is 0.5 degree C. The base period for the normal is 1981-2010. Maximum coverage with sea ice is shaded in gray.

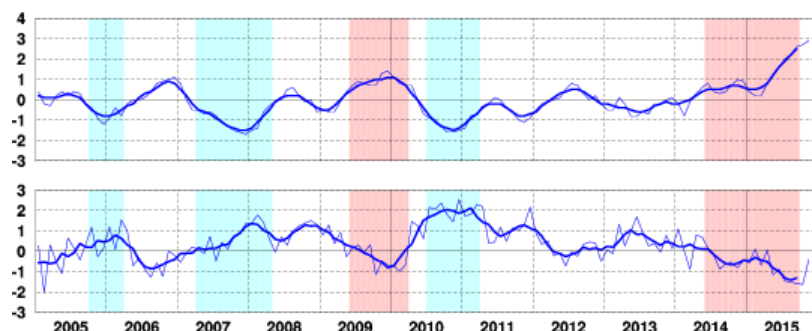


Fig. 10 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1981-2010 base period (lower). Thin blue lines represent monthly 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 (September 2015 – November 2015)

- Remarkably positive SST anomalies were observed from near the date line to the eastern part of the equatorial Pacific.
- Convective activity was enhanced over the equatorial Pacific, and was suppressed over the Maritime Continent.
- In the 500-hPa height field, positive anomalies were widely observed except the Pacific side of the Arctic Sea to Greenland and Central Asia. The significant positive anomalies were seen over Central Siberia and the northern Pacific.
- Seasonal mean temperatures were high in many parts of low latitudes, including the Arabian Peninsula, southern India and the southwestern USA to northwestern part of South America.
- Seasonal mean temperatures were significantly above normal in Okinawa/Amami, and near normal in northern, eastern and western Japan, respectively. Seasonal precipitation ratio was above normal in the Pacific side of northern and eastern Japan, and significantly below normal in Okinawa/Amami.

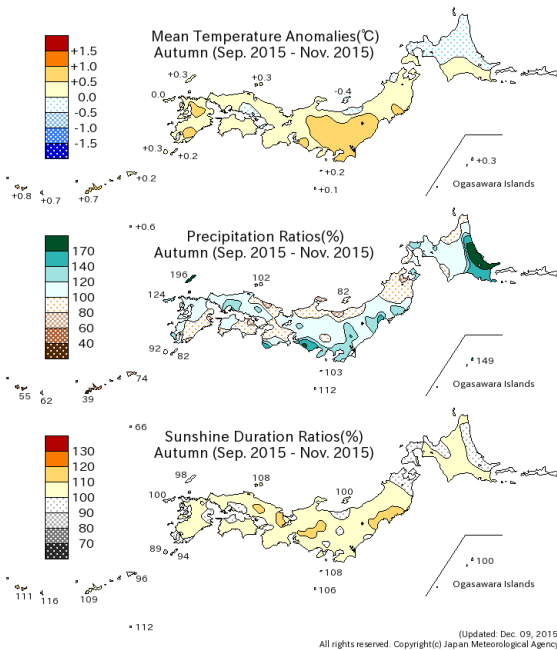


Fig. S1 Seasonal climate anomaly / ratio over Japan (September 2015 - November 2015)  
Top: Temperature anomalies (degree C)  
Middle: Precipitation ratio (%)  
Bottom: Sunshine duration ratio (%)  
Anomalies are defined as the deviations from the normal (1981-2010 average).

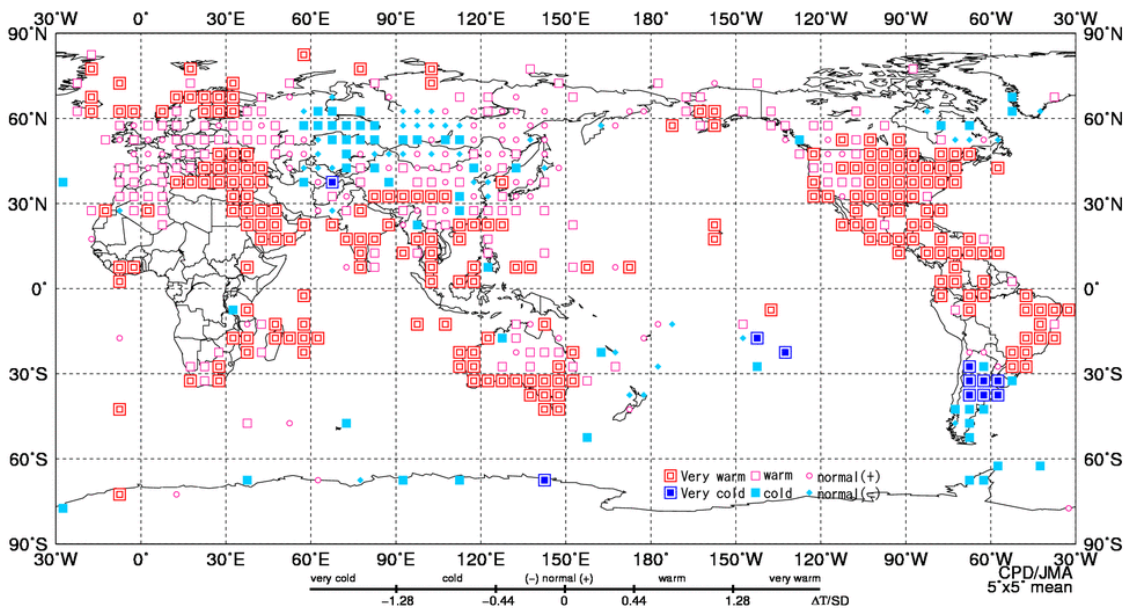


Fig. S2 Three-month mean temperature anomaly (normalized) category (September 2015 - November 2015)

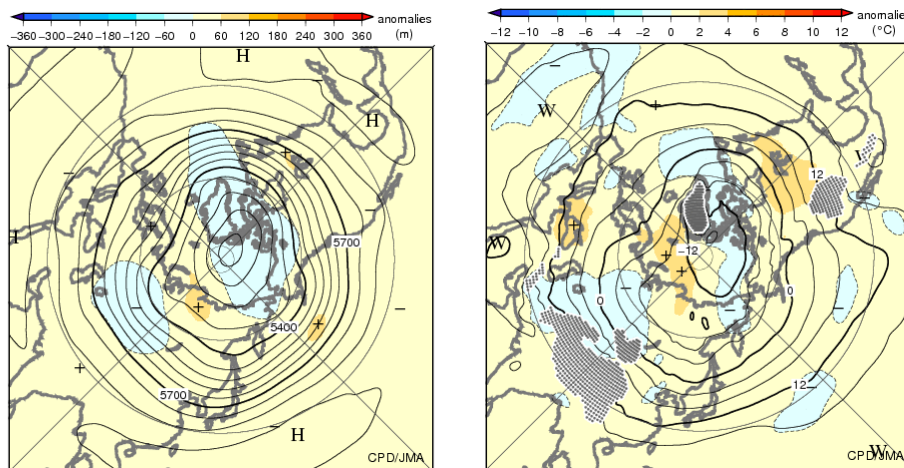


Fig. S3 Three-month mean 500-hPa height and anomaly (left) and 850-hPa temperature and anomaly (right) in the Northern Hemisphere (September 2015 - November 2015)

The contour intervals are 60 m (left) and 4 degree C (right). The shading shows anomalies. The base period for the normal is 1981-2010.

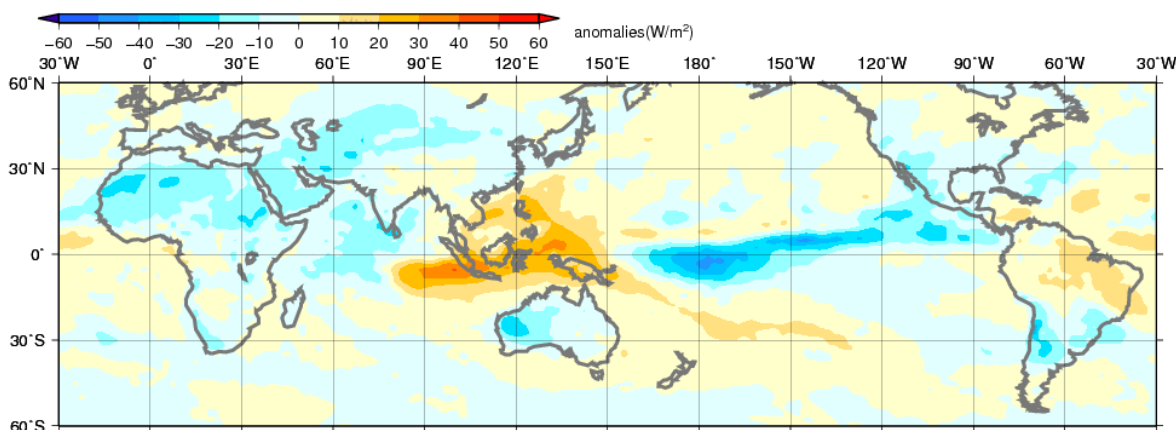


Fig. S4 Three-month mean Outgoing Longwave Radiation (OLR) anomaly (September 2015 - November 2015)  
The contour interval is 10 W/m<sup>2</sup>. The base period for the normal is 1981-2010. Original data provided by NOAA.

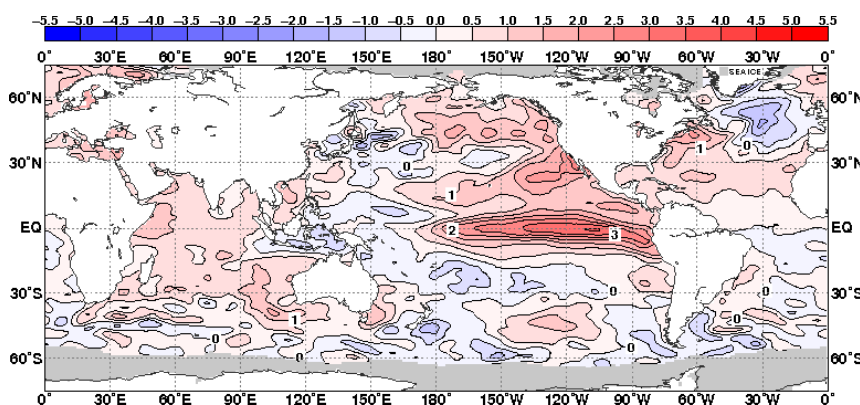


Fig. S5 Three-month mean sea surface temperature anomaly (September 2015 - November 2015)  
The contour interval is 0.5 degree C. The base period for the normal is 1981-2010.

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