Monthly Highlights on the Climate System (December 2014)

Highlights in December 2014
- El Niño conditions are present in the equatorial Pacific (see *El Niño Outlook* updated on 9 January 2015).
- Monthly mean temperatures were below normal all over Japan.
- Monthly mean temperatures were extremely high from the western USA to Mexico.
- The Aleutian Low and the Siberian High were both stronger than normal, indicating stronger-than-normal winter monsoon around Japan.
- In the upper troposphere, anticyclonic circulation anomalies were seen around the southern part of China, and cyclonic anomalies were seen around Japan.
- Positive SST anomalies were observed in almost the entire region of the equatorial Pacific.

Climate in Japan:

Since the winter monsoon pattern was stronger than normal, monthly mean temperatures were below normal nationwide. Snowfall amounts were above normal on the Sea of Japan side of the country. On the Sea of Japan side of northern and eastern Japan monthly precipitation amounts were the highest on record for December since 1946 due to cold surges and frequently passing cyclones near Japan.

World Climate:

The monthly anomaly of the global average surface temperature in December 2014 (i.e., the combined average of the near-surface air temperature over land and the SST) was +0.31°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 0.72°C per century in December (preliminary value).

Extreme climate events were as follows (Fig. 3).
- Monthly precipitation amounts were extremely heavy in northwestern and southeastern Europe.
- Monthly mean temperatures were extremely high from the western USA to Mexico.
- Monthly mean temperatures were extremely high in northern Australia.

Extratropics:

In the 500-hPa height field (Fig.4), a blocking ridge developed over Eastern Siberia, and the polar vortex was shifted toward the Atlantic. Positive anomalies were observed from Siberia to the Arctic Ocean and from eastern Canada to the Atlantic, and negative anomalies were observed from Greenland to northwestern Russia. A deep trough was seen around Japan. The subtropical jet stream from China to the Pacific was stronger than normal (Fig. 5). The Aleutian Low and the Siberian High were both stronger than normal, indicating stronger-than-normal winter monsoon around Japan.

Tropics:

Convective activity was enhanced over the Arabian Sea, India, the eastern Indian Ocean, around Indonesia, the South China Sea, and the central Pacific, and was suppressed over the western Indian Ocean south of the equator and the western Pacific south of the equator (Fig. 6). The active phase of the amplified Madden-Julian Oscillation (MJO) propagated eastward from Indonesia to the Pacific in the first half of December and from the Indian Ocean to Indonesia in the second half of the month (Fig. 7). In the equatorial lower troposphere, westerly wind anomalies were dominant over the Indian Ocean, and easterly anomalies were seen over the western Pacific (Fig. 7). In the upper troposphere, anticyclonic circulation anomalies were seen around the southern part of China, and cyclonic anomalies were seen around Japan (Fig. 8). The Southern Oscillation Index value was -0.4 (Fig. 10).

Oceanographic Conditions:

Positive SST anomalies were observed in almost the entire region of the equatorial Pacific. The monthly mean SST anomaly in the NINO.3 region was +0.8°C and the SST deviation from the latest sliding 30-year mean was +0.9°C.

In the North Pacific, remarkably positive SST anomalies were observed from the Bering Sea to south of Alaska and from the coast of North America to near 10˚N, 150˚W and in the western part of tropical region, and negative SST anomalies were observed from south of Japan to near 35˚N, 145˚W. In the South Pacific, remarkably positive SST anomalies were observed from near 35˚S, 145˚W to near 45˚S, 100˚W, and remarkably negative SST anomalies were observed from the coast of Chile to near 20˚S, 145˚W.

In the Indian Ocean, remarkably positive SST anomalies were observed from near Madagascar to the west of Australia.

In the Atlantic, remarkably positive SST anomalies were observed from near the eastern coast of North America to near 35˚N, 30˚W, and remarkably negative SST anomalies were observed in the equatorial region and around 50˚N, 25˚W.

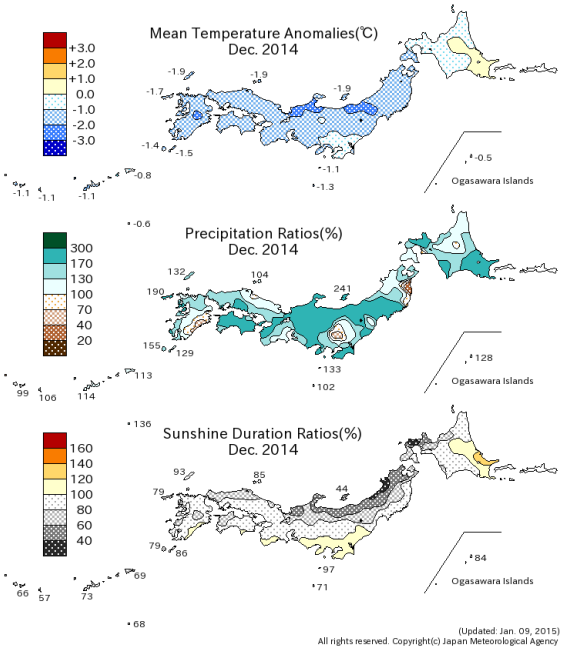

Fig. 1 Monthly climate anomaly / ratio over Japan (December 2014)
Top: temperature anomalies (degree C)
Middle: precipitation ratio (%)
Bottom: sunshine duration ratio (%)
Anomalies are defined as the deviations from the normal (1981-2010 average).

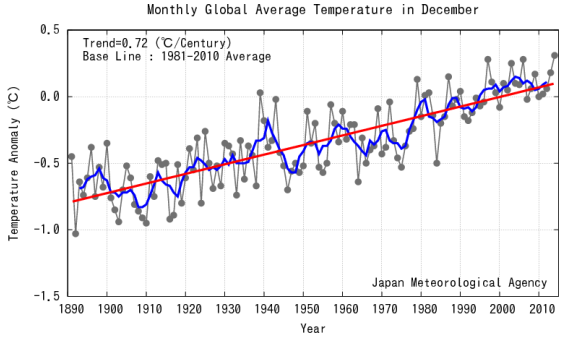

Fig. 2 Long-term change in monthly anomalies of global average surface temperature in December
The thin black line indicates anomalies of the surface temperature in each year. The blue line indicates five-year running mean, and the red line indicates a long-term linear trend. Anomalies are deviations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

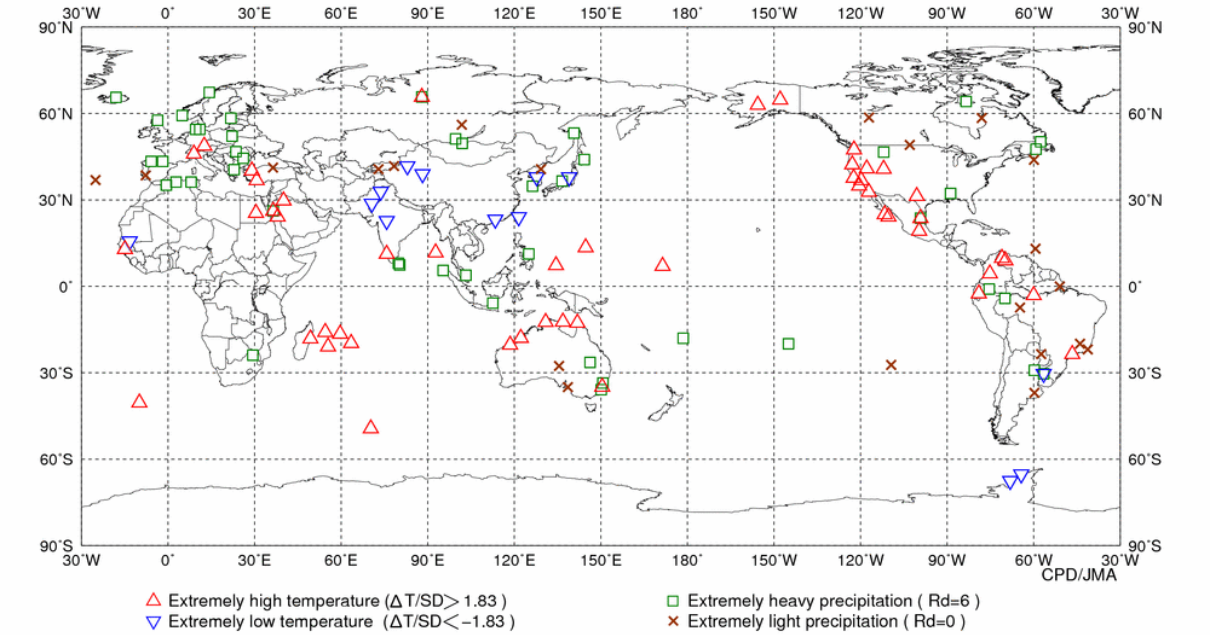

Fig. 3 Distribution of extreme climate events (December 2014)

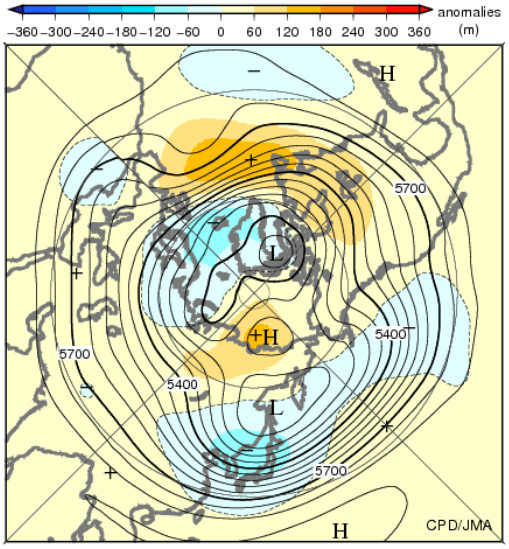

Fig. 4 Monthly mean 500-hPa height and anomaly in the Northern Hemisphere (December 2014)
The contours show heights at intervals of 60 m. The shading indicates height anomalies. The base period for the normal is 1981-2010.

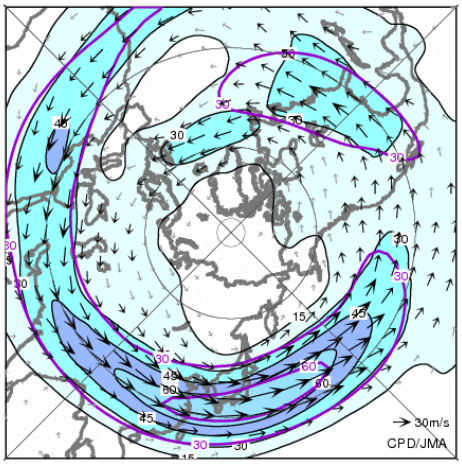

Fig. 5 Monthly mean 200-hPa wind speed and vectors in the Northern Hemisphere (December 2014)
The black lines show wind speeds at intervals of 15 m/s. The dark blue shading shows values greater than 30 m/s. The purple lines show normal wind speeds at intervals of 30 m/s. The base period for the normal is 1981-2010.

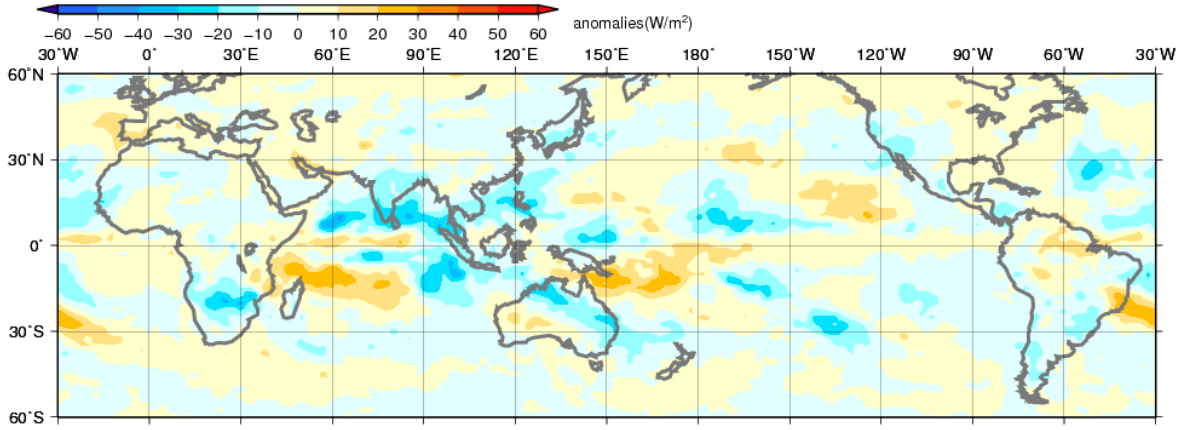

Fig. 6 Monthly mean Outgoing Longwave Radiation (OLR) anomaly (December 2014)
The contour interval is 10 W/m^2. The base period for the normal is 1981-2010. Original data provided by NOAA.

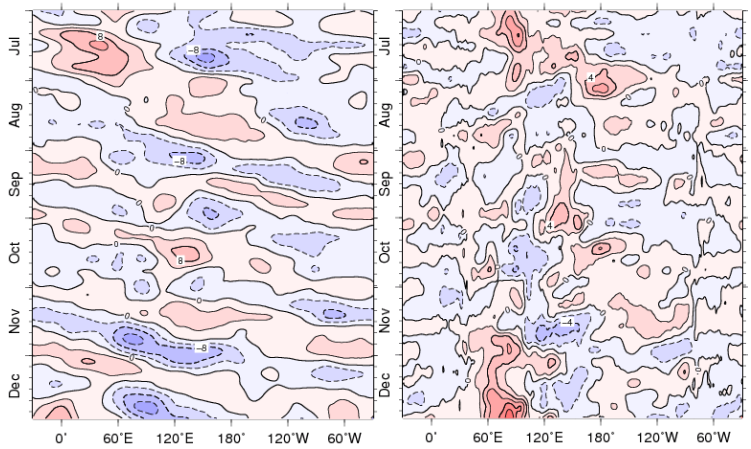

Fig. 7 Time-Longitude cross section (5°N-5°S) of five-day running mean 200-hPa velocity potential anomaly (left) and 850-hPa zonal wind anomaly (right) (July 2014- December 2014)
The contour intervals are 4x10^6 m^2/s (left) and 2 m/s (right). The base period for the normal is 1981-2010.

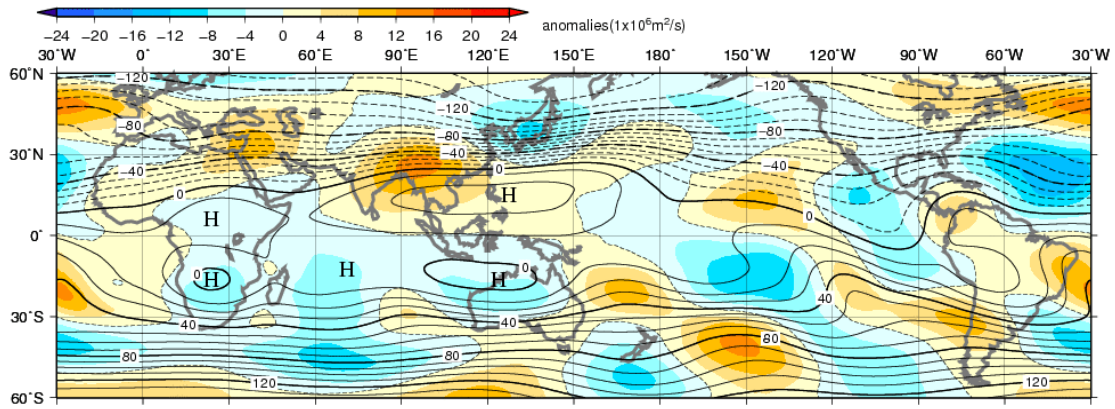

Fig. 8 Monthly mean 200-hPa stream function and anomaly (Decedmber 2014)

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

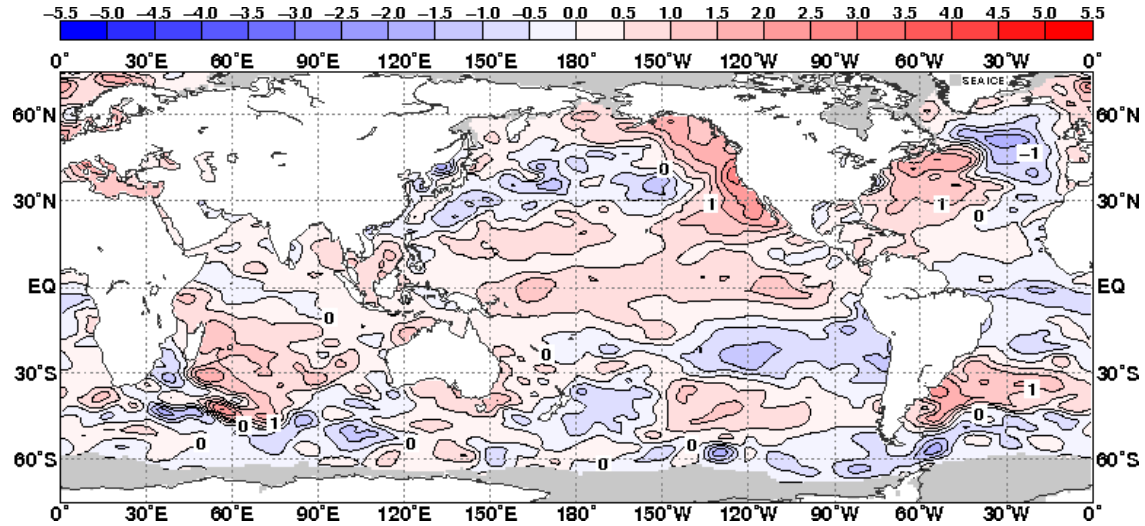

Fig. 9 Monthly mean sea surface temperature anomaly (December 2014)

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.

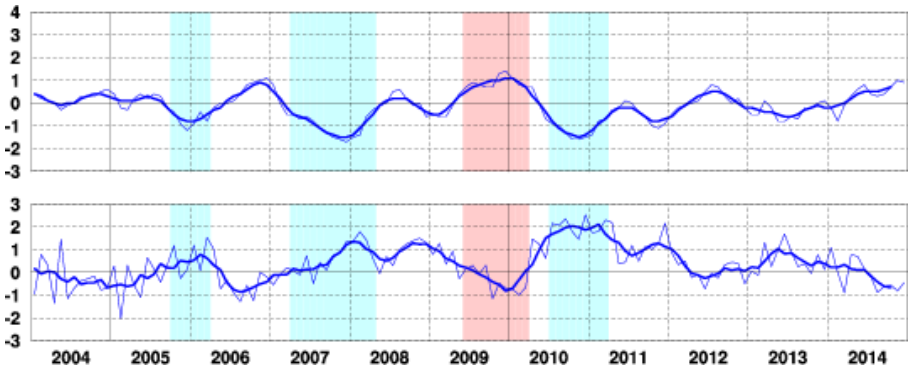

Fig. 10 Time series of monthly mean SST departure (degree C) from the reference value defined as the immediate past 30-year mean SST averaged over the NINO.3 region (upper). Time series of the Southern Oscillation Index with respect to the 1981-2010 base period (lower).

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.