Tokyo Climate Center, Japan Meteorological Agency

TCC News

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From the editor

Thank you for reading this landmark 50th issue of the TCC (Tokyo Climate Center) News. TCC has provided these quarterly updates to climate experts at National Meteorological and Hydrological Services (NMHSs) and elsewhere worldwide since July 2005 prior to its 2009 RA II WMO Regional Climate Center (RCC) designation. TCC News has covered areas ranging from regular climate information (seasonal forecasts, the ENSO outlook and climate monitoring, including sea ice and atmospheric ozone conditions) to newly developed TCC products, including geostationary meteorological satellite data. The publication thus represents an effective outlet for updates on TCC activities.

As well as providing information on technological matters, TCC News highlights capacity building based on annual training seminars and expert visits among other topics. As part of its RCC development efforts, the Center also holds annual training seminars on the application of its climate monitoring and prediction products. A total of 127 experts in the region have attended these seminars since their introduction in 2008 (as of November 2017). Since 2006, TCC has also arranged 20 visits by TCC experts to NMHSs for discussions on collaboration, technical transfer and training seminars. Thanks are due to the relevant NMHSs for their involvement in these activities. Other areas of assistance include contribution to Regional Climate Outlook Forums (RCOFs), in which TCC has participated by sending experts and/or providing seasonal forecast materials. RCOFs also provide valuable opportunities for TCC to interact directly with users engaging in climate services with TCC products and to collect related feedback. Such input contributes significantly to the improvement of TCC products and RCOF activities. With respect to RCOFs, this issue reports on the WMO Workshop on Global Review of RCOFs held in September 2017. TCC News is thus expected to be useful in exchanges of climate-related information.

Since its 2009 designation as an RA II WMO Regional Climate Center, the Center has advanced its NMHS support via the provision of tools, data and products, e.g., a web-based climate analysis application, iTacs (Interactive Tool for Analysis of the Climate System), the Japan Meteorological Agency's (JMA's) reanalysis data (current version: JRA-55) as fundamental data for climate analysis and monitoring, early warning products for extreme weather events and the Monthly Discussion on Seasonal Climate Outlook.

Toward the establishment of the Global Framework for Climate Services (GFCS), JMA held an event titled *"Tokyo Climate Conference: Better Climate Information for a Safe and Sustainable Society"* in Tokyo, Japan, in July 2009, to support collaboration among relevant bodies toward the establishment of a new international framework for climate services. Today the GFCS represents a leading WMO priority under which NMHSs play a key role in providing high-quality, high-precision climate information based on user needs. In this context, it is important to share information on climate services, good practices and lessons learned in climate information usage. TCC operates a dedicated website for this purpose, thereby helping to improve climate services in RA II (see also the website update article in this newsletter).

TCC News will hopefully help to promote active communication among climate operators and support the provision of climate services by Asia Pacific NMHSs.

(Kiyotoshi Takahashi, Head of Tokyo Climate Center)

El Nino Outlook (November 2017 – May 2018)

The continuation of the below-normal NINO.3 SST until boreal winter is likely (60%) to meet JMA's definition of a La Niña event, although the criterion may not be met (40%). (Article based on the El Niño outlook issued on 10 November 2017.)

El Niño/La Niña

In October 2017, the NINO.3 SST was below normal with a deviation of -0.6°C. SSTs in October were below normal in the central and eastern equatorial Pacific (Figures 1 and 3(a)). Subsurface temperatures were below normal in the central and eastern equatorial Pacific (Figures 2 and 3(b)). Atmospheric convective activity was below normal near the date line over the equatorial Pacific, and easterly winds in the lower troposphere (trade winds) were stronger than normal over the central equatorial Pacific. These oceanic and atmospheric conditions indicate that common characteristics of past La Niña events persisted in October.

Cold subsurface waters in the central and eastern equatorial Pacific are likely to move eastward, supporting cooler-than-normal SST conditions in the eastern part. JMA's El Niño prediction model suggests that the NINO.3 SST will remain below normal until winter. During late winter and spring, its value is expected to approach the normal, and prediction uncertainty will gradually increase (Figure 4). In conclusion, it is more likely (60%) that continuation of below-normal NINO.3 SST until boreal winter will meet the JMA's definition of La Niña event, although it is possible (40%) that the criterion will not be met (Figure 5).

Western Pacific and Indian Ocean

The area-averaged SST in the tropical western Pacific (NINO.WEST) region was above normal in October. Values are likely to be generally near normal until boreal winter.

The area-averaged SST in the tropical Indian Ocean (IOBW) region was near normal in October. Values are likely to be near or below normal until boreal winter.

(Ichiro Ishikawa, Climate Prediction Division)

* The SST normal for the NINO.3 region (5°S – 5°N, 150°W – 90°W) is defined as an monthly average over the latest sliding 30-year period (1987-2016 for this year). Based on this normal, JMA judges an El Niño (La Niña) event when the five-month running mean of the NINO.3 SST deviates from the normal by +0.5°C (-0.5°C) or more (less) for six months or more.

* The SST normals for the NINO.WEST region (Eq. – 15°N, 130°E – 150°E) and the IOBW region (20°S – 20°N, 40°E – 100°E) are defined as linear extrapolations with respect to the latest sliding 30-year period, in order to remove the effects of significant long-term warming trends observed in these regions.

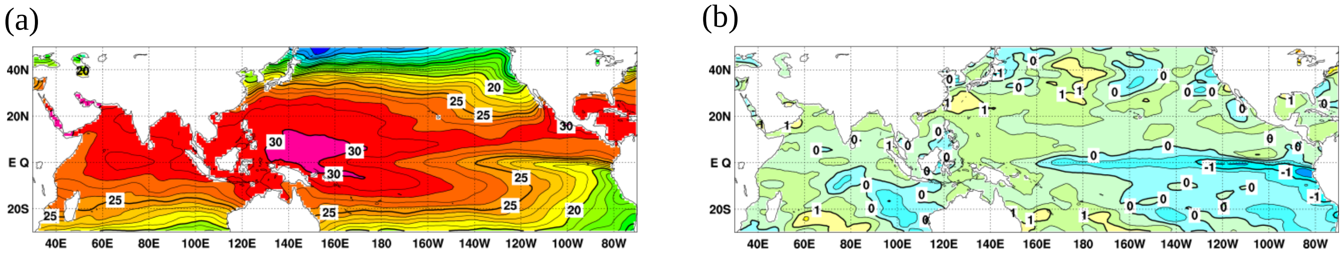


Figure 1 Monthly mean (a) sea surface temperatures (SSTs) and (b) SST anomalies in the Indian and Pacific Ocean areas for October 2017

The contour intervals are 1˚C in (a) and 0.5˚C in (b). The base period for the normal is 1981 – 2010.

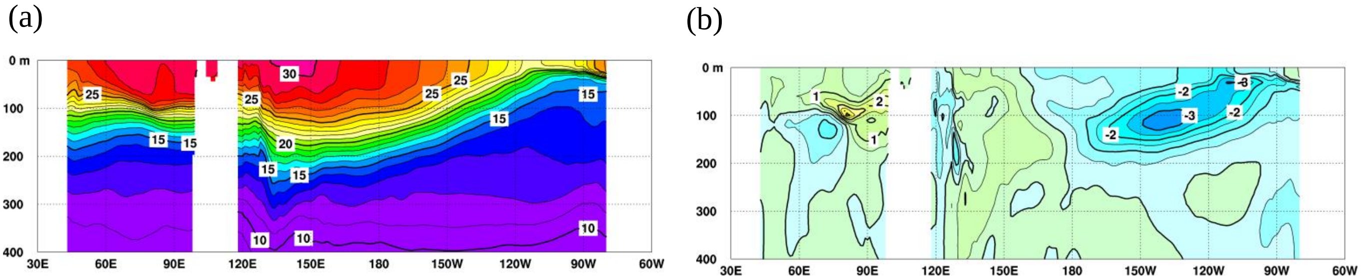


Figure 2 Monthly mean depth-longitude cross sections of (a) temperatures and (b) temperature anomalies in the equatorial Indian and Pacific Ocean areas for October 2017

The contour intervals are 1˚C in (a) and 0.5˚C in (b). The base period for the normal is 1981 – 2010.

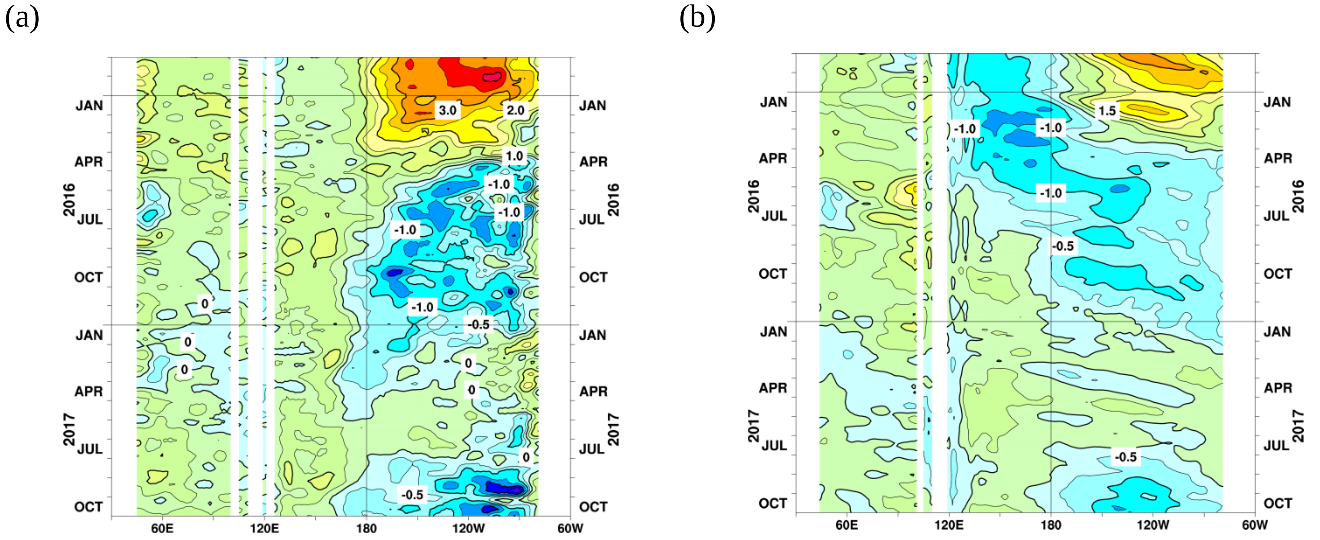


Figure 3 Time-longitude cross sections of (a) SST and (b) ocean heat content (OHC) anomalies along the equator in the Indian and Pacific Ocean areas

OHCs are defined here as vertical averaged temperatures in the top 300 m. The base period for the normal is 1981 – 2010.

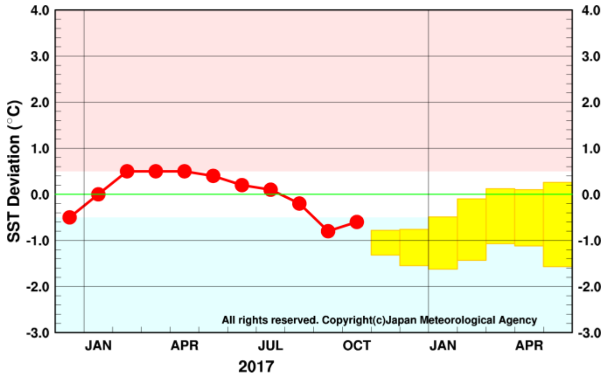
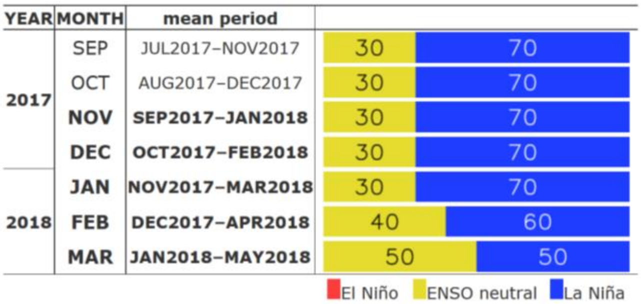


Figure 4 Outlook of NINO.3 SST deviation produced by the El Niño prediction model

This figure shows a time series of monthly NINO.3 SST deviations. The thick line with closed circles shows observed SST deviations, and the boxes show the values produced for up to six months ahead by the El Niño prediction model. Each box denotes the range into which the SST deviation is expected to fall with a probability of 70%.



YEAR	MONTH	mean period	ENSO neutral	La Niña
2017	SEP	JUL2017–NOV2017	30	70
	OCT	AUG2017–DEC2017	30	70
	NOV	**SEP2017–JAN2018**	30	70
	DEC	**OCT2017–FEB2018**	30	70
2018	**JAN**	**NOV2017–MAR2018**	30	70
	FEB	**DEC2017–APR2018**	40	60
	MAR	**JAN2018–MAY2018**	50	50

🟥El Niño 🟨ENSO neutral 🟦La Niña

Figure 5 ENSO forecast probabilities based on the El Niño prediction model

Red, yellow and blue bars indicate probabilities that the five-month running mean of the NINO.3 SST deviation from the latest sliding 30-year mean will be +0.5°C or above (El Niño), between +0.4 and -0.4°C (ENSO-neutral) and -0.5°C or below (La Niña), respectively. Regular text indicates past months, and bold text indicates current and future months.

JMA's Seasonal Numerical Ensemble Prediction for Winter 2017/2018

Based on JMA's seasonal ensemble prediction system, sea surface temperature (SST) anomalies are predicted to be below normal in the equatorial Pacific during boreal winter 2017/2018, suggesting La Niña-like conditions. In association with these conditions, inactive convection is predicted over the equatorial Pacific, while active convection is predicted over the region from the Bay of Bengal across the Indochina Peninsula and the South China Sea to the Philippines. The Aleutian Low is predicted to be weaker than normal over the sea off the western coast of North America, while the Siberian High is predicted to be slightly stronger than normal over the region from the southeastern edge of China to the southern part of Japan. However, colder conditions associated with the slightly stronger Siberian High may be offset by global warming trends and thickness over the Northern Hemisphere.

1. Introduction

This article outlines JMA's dynamical seasonal ensemble prediction for boreal winter 2017/2018 (December – February, referred to as DJF), which was used as a basis for JMA's operational cold-season outlook issued on 24 November 2017. The outlook is based on the seasonal ensemble prediction system of the Coupled Atmosphere-ocean General Circulation Model (CGCM). See the column below for system details.

Section 2 outlines global SST anomaly predictions, and Section 3 describes the associated circulation field predictions for the tropics and sub-tropics. Finally, the circulation fields predicted for the mid- and high-latitudes of the Northern Hemisphere are discussed in Section 4.

2. SST anomalies (Figure 6)

Figure 6 shows predicted SSTs (contours) and related anomalies (shading) for DJF. For SST conditions in the tropical Pacific, below normal anomalies are predicted in the equatorial Pacific, suggesting La Niña-like conditions. Conversely, above-normal anomalies are predicted in the latitudinal band of about 5 – 15°N in the North Pacific, representing a minimal northern spread of La Niña-like conditions. Meanwhile, normal SST conditions are predicted in the Indian Ocean.

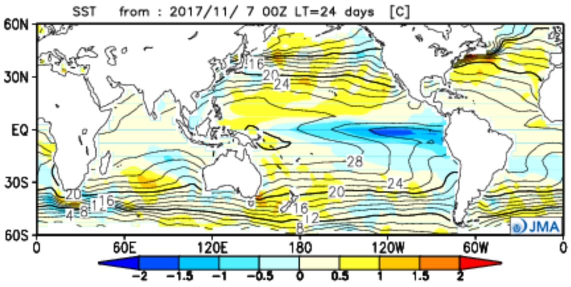


Figure 6 Predicted SSTs (contours) and SST anomalies (shading) for December–February 2017/2018 (ensemble mean of 51 members)

3. Prediction for the tropics and sub-tropics (Figure 7)

Figure 7 (a) shows predicted precipitation (contours) and related anomalies (shading) for DJF. Above-normal anomalies are predicted over the latitudinal band of about 5 – 15°N in the North Pacific in association with warmer-than-normal SSTs, while below-normal anomalies are predicted over the equatorial Pacific in association with colder-than-normal SSTs.

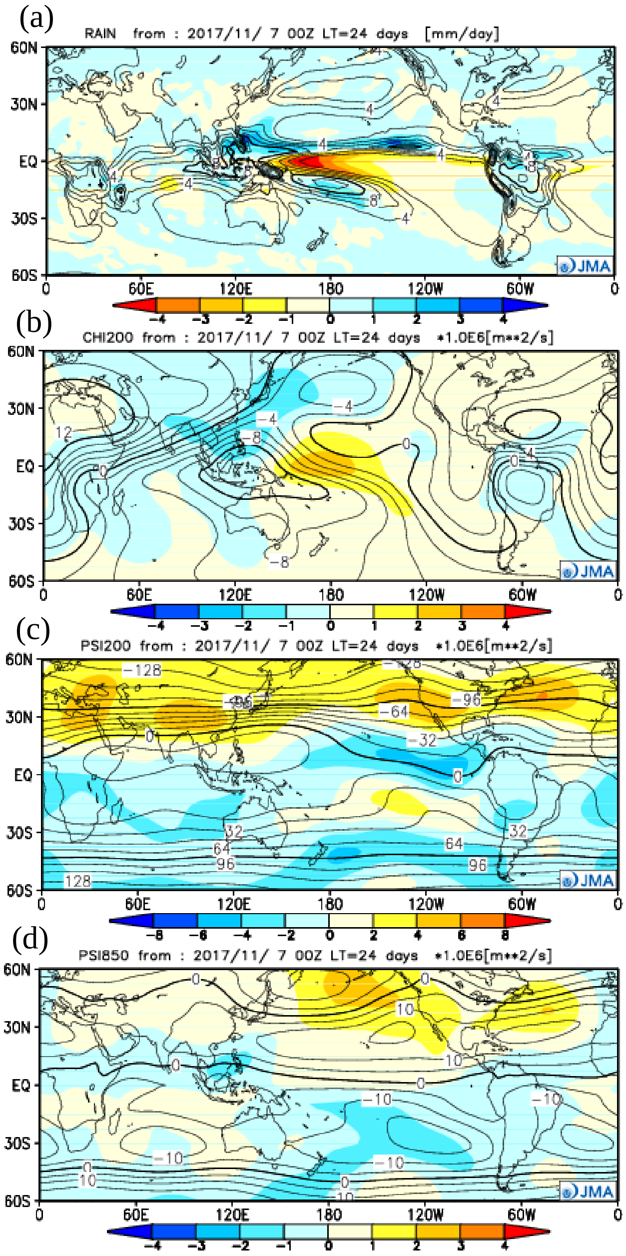


Figure 7 Predicted atmospheric fields from 60°N – 60°S for December–February 2017/2018 (ensemble mean of 51 members)

(a) Precipitation (contours) and anomaly (shading). The contour interval is 2 mm/day.

(b) Velocity potential at 200 hPa (contours) and anomaly (shading). The contour interval is 2 × 106 m2/s.

(c) Stream function at 200 hPa (contours) and anomaly (shading). The contour interval is 16 × 106 m2/s.

(d) Stream function at 850 hPa (contours) and anomaly (shading). The contour interval is 5 × 106 m2/s.

Figure 7 (b) shows predicted velocity potential (contours) and related anomalies (shading) at the upper troposphere (200 hPa) for DJF. Positive (i.e., convergent) anomalies are predicted over the equatorial Pacific in association with light precipitation. Conversely, negative (i.e., divergent) anomalies are predicted over the region from the Bay of Bengal across the Indochina Peninsula and the area from the South China Sea to the Philippines.

Figure 7 (c) shows predicted stream functions (contours) and related anomalies (shading) at the upper troposphere (200 hPa) for DJF. Positive (i.e., anticyclonic) anomalies are predicted in the most of the Northern Hemisphere, indicating a northward-shift tendency for the subtropical jet stream. Focusing on the strength of positive anomalies, anticyclonic anomalies are expected over China in association with active convection in and around the South China Sea and the Philippines. Conversely, equatorial symmetric negative (i.e., cyclonic) anomalies are predicted over the eastern part of the tropical Pacific in association with La Niña like conditions.

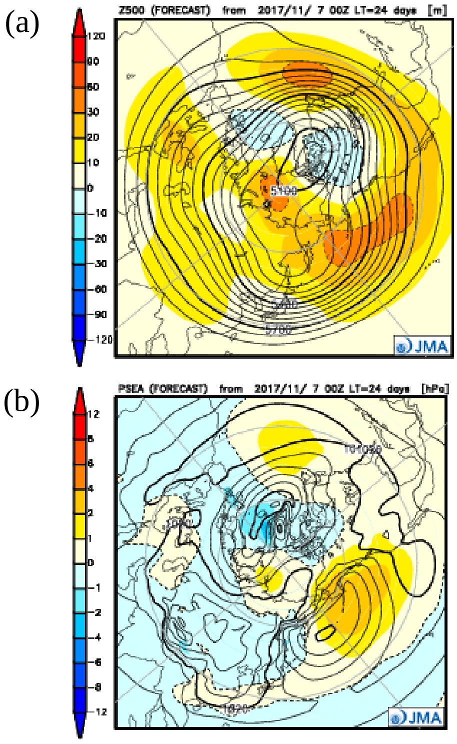
Figure 7 (d) shows predicted stream functions (contours) and related anomalies (shading) at the lower troposphere (850 hPa) for DJF. Negative (i.e., cyclonic) anomalies are predicted in and around the South China Sea and the Philippines in association with heavier-than-normal precipitation. Conversely, positive anomalies are seen over the sea off the western coast of North America in association with the negative phase of the Pacific North America (PNA) teleconnection as clearly observed during past La Niña events.

4. Prediction for the mid- and high- latitudes of the Northern Hemisphere

Figure 8 (a) shows predicted geopotential heights (contours) and related anomalies (shading) at 500 hPa for DJF. Positive anomalies are predicted over most of the Northern Hemisphere in association with global warming trends and high thickness related to active convection over warm SST conditions in the latitudinal band of about 5 – 15°N in the North Pacific. Focusing on the strength of positive anomalies, large positive anomalies are seen over the sea off the western coast of North America in association with the negative phase of the PNA teleconnection.

Figure 8 (b) shows predicted sea level pressure (contours) and related anomalies (shading) for DJF. Positive anomalies are predicted over the sea off the western coast of North America in association with the negative phase of the PNA teleconnection, suggesting a weaker-than-normal Aleutian Low. Meanwhile, small negative anomalies are also predicted over most of China and the southern part of Siberia, suggesting a slightly weaker-than-normal Siberian High. However, this should be interpreted with caution due to significant uncertainty. Conversely, small positive anomalies are predicted over the region from the southeastern edge of China to the southern part of Japan, suggesting a slightly stronger-than-normal Siberian High. However, normal surface temperatures are expected in these regions because the colder conditions associated with this slight increase may be offset by global warming trends and high thickness over the Northern Hemisphere.

(Takashi Yamada, Climate Prediction Division)



Figures 8 Predicted atmospheric fields from 20°N – 90°N for December–February 2017/2018 (ensemble mean of 51 members)

(a) Geopotential height at 500 hPa (contours) and anomaly (shading). The contour interval is 60 m.

(b) Sea level pressure (contours) and anomaly (shading). The contour interval is 4 hPa.

JMA's Seasonal Ensemble Prediction System

JMA operates a seasonal Ensemble Prediction System (EPS) using the Coupled atmosphere-ocean General Circulation Model (CGCM) to make seasonal predictions beyond a one-month time range. The EPS produces perturbed initial conditions by means of a combination of the initial perturbation method and the lagged average forecasting (LAF) method. The prediction is made using 51 members from the latest four initial dates (13 members are run every 5 days). Details of the prediction system and verification maps based on 30-year hindcast experiments (1981–2010) are available at http://ds.data.jma.go.jp/tcc/tcc/products/model/.

Cold Season Outlook for Winter 2017/2018 in Japan

JMA issued its outlook for the coming winter (December 2017 – February 2018) over Japan in September and updated it in October based on the Agency's seasonal Ensemble Prediction System (EPS). This article outlines the outlook update of 25 October.

1. Outlook summary (Figure 9)

- In northern Japan, seasonal mean temperatures are expected to exhibit above-normal tendencies and seasonal snowfall amounts for the Sea of Japan side are expected to exhibit below-normal tendencies due to enhanced low-pressure systems and weaker-than-normal cold-air advection from higher latitudes. Seasonal precipitation amounts for the Pacific side of northern Japan are expected to exhibit above-normal tendencies.
- In western Japan, seasonal snowfall and precipitation amounts for the Sea of Japan side are expected to exhibit above-normal tendencies due to significant influences of cold-air inflow from the continent.

2. Outlook background

Figure 10 highlights expected large-scale oceanic/atmospheric characteristics for winter. An outline of the background to the outlook is given below.

- It is equally likely that La Niña conditions will develop in boreal autumn or winter and that ENSO-neutral conditions will persist until boreal winter. Accordingly, sea surface temperatures (SSTs) are expected to be above normal over the western tropical Pacific.
- In association with the expected SST anomalies in the tropics, convection over the tropics is expected to be enhanced from the Indian Ocean to Southeast Asia, especially around the Philippines, and suppressed around the date line.
- In upper circulation fields, the jet stream is expected to meander northward over southern China and southward to the east of Japan. This pattern tends to appear when SSTs over the western tropical Pacific are above normal.
- The Siberian High is expected to be stronger than normal in its southeastern part in association with northward meandering of the jet stream over southern China, indicating a strong winter monsoon from eastern/western Japan to Okinawa/Amami.
- Around northern Japan, low-pressure system activity is expected to be enhanced, while cold-air advection is expected to be weaker than normal in association with enhanced convective activity around the Philippines.
- Overall temperatures in the troposphere are expected to be above-normal over the Northern Hemisphere in association with the prevailing long-term trend.

(Hiroshi Ohno, Climate Prediction Division)

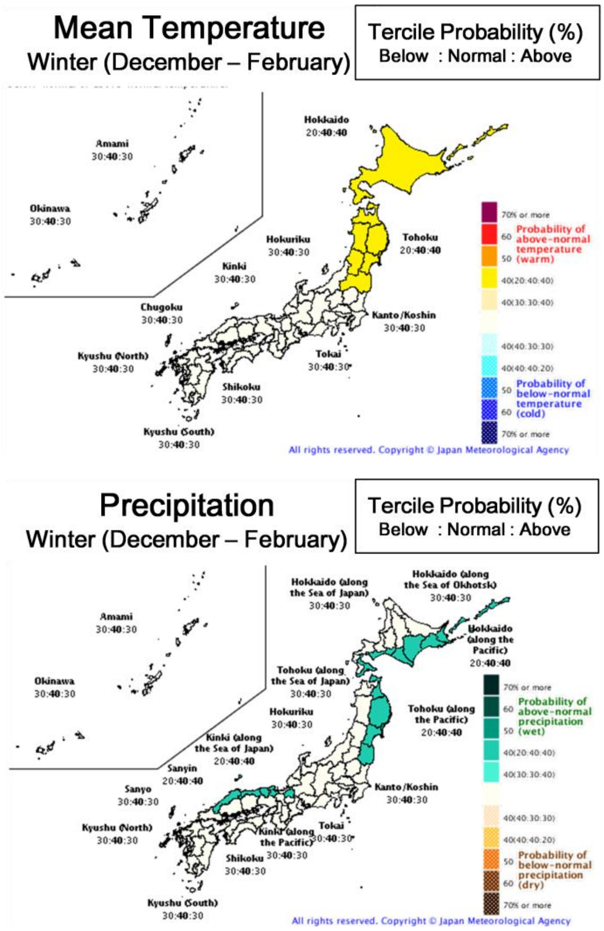


Figure 9 Outlook for winter 2017/2018 temperature (above) and precipitation (below) probability in Japan.

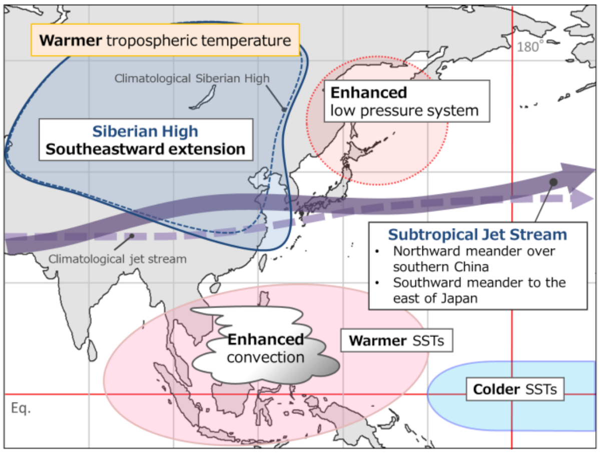


Figure 10 Conceptual diagram showing expected large-scale ocean/atmosphere characteristics for winter 2017/2018

Summary of the 2017 Asian Summer Monsoon

1. Precipitation and temperature

Four-month total precipitation amounts based on CLIMAT reports during the monsoon season (June – September) were more than 140% of the normal in and around India and from southern Philippines to the New Guinea Island. Conversely, the corresponding figures were less than 60% of the normal from the Korean Peninsula to northeastern China, in northwestern China and southwestern Pakistan (Figure 11). In August, monsoonal heavy rain causing flooding and landslides in Bangladesh, India and Nepal resulted in more than total 1,800 fatalities. From the Korean Peninsula to northeastern China, extremely low precipitation totals were observed in July and September, with South Korea recording the third-lowest July amount since KMA observation began in 1973.

Four-month mean temperatures for the same period were more than 1°C above normal in western Mongolia, eastern China and the Korean Peninsula, and slightly below normal in and around India, and in the western part of Indochina Peninsula (Figure 12). In mid and late July, China experienced extreme heatwave conditions from its central to eastern provinces, with temperatures reaching 42°C in parts of Hebei, Shaanxi, Shanxi and Xinjiang on July 13 according to CMA.

2. Tropical cyclones

A total of 19 tropical cyclones (TCs[1]) had formed over the western North Pacific up to September 2017 as compared to the normal of 18.4. July's total of 8 represented a significant increase over the normal of 3.6 (Table 1). From June to September, a total 10 TCs hit the area from southern China to the Indochina Peninsula over the South China Sea. Among these, Typhoons Hato and Pakhar made landfall in series late August in almost the same location in southern China, resulting in more than 120 total fatalities (sources: Government of China, Government of Macau). Typhoon Noru had JMA's second-longest duration (19.0 days) since 1951, forming on July 20 near Minami Torishima Island and degrading to extratropical cyclone status on August 8 over the Sea of Japan. Noru drifted over a warm SST region southeast of Japan for most of its lifetime due to interaction known as the Fujiwara effect with Typhoon Kulap and weak steering flow from the Western North Pacific subtropical high located far to its east.

3. Monsoon activity and atmospheric circulation

Convective activity (inferred from OLR) averaged for June – September 2017 was enhanced over the Maritime Continent, from east China to the Indochina Peninsula and India, and was suppressed over the equatorial Indian Ocean, over the Bay of Bengal and from southern China to the seas east of the Philippines (Figure 13).

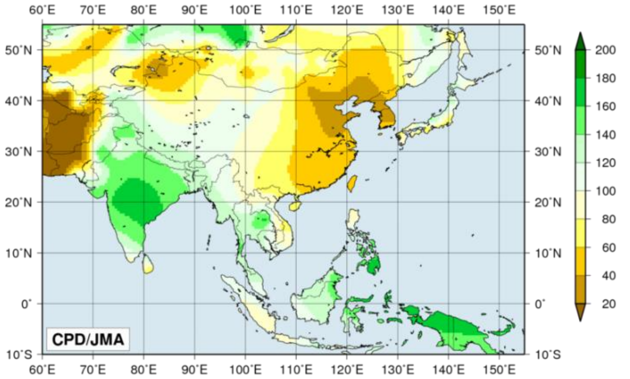


Figure 11 Four-month precipitation ratios (%) from June to September 2017

The base period for normal is 1981 – 2010. Note that the data in Vietnam, Thailand and Cambodia are interpolated due to the lack of CLIMAT report or climatological normal.

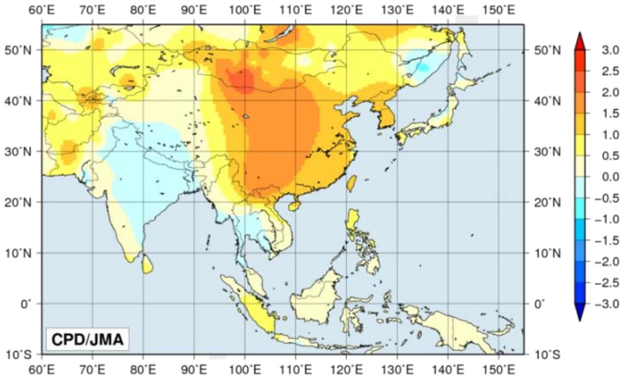


Figure 12 Four-month mean temperature anomalies (°C) from June to September 2017

The base period for normal is 1981 – 2010. Note that the data in Vietnam, Thailand and Cambodia are interpolated due to the lack of CLIMAT report or climatological normal.

Table 1 Tropical cyclones forming over the western North Pacific up to September 2017

Number ID	Name	Date (UTC)	Category1)	Maxumum wind2) (knots)
T1701	Muifa	4/25-4/27	TS	35
T1702	Merbok	6/11-6/12	STS	55
T1703	Nanmadol	7/2-7/4	STS	55
T1704	Talas	7/15-7/17	STS	50
T1705	Noru	7/20-8/8	TY	95
T1706	Kulap	7/21-7/25	TS	40
T1707	Roke	7/22-7/23	TS	35
T1708	Sonca	7/23-7/25	TS	35
T1709	Nesat	7/25-7/30	TY	80
T1710	Haitang	7/28-7/31	TS	45
T1711	Nalgae	8/2-8/5	TS	45
T1712	Banyan	8/11-8/17	TY	80
T1713	Hato	8/20-8/24	TY	75
T1714	Pakhar	8/24-8/27	STS	55
T1715	Sanvu	8/28-9/3	TY	80
T1716	Mawar	8/31-9/3	STS	50
T1717	Guchol	9/5-9/6	TS	35
T1718	Talim	9/9-9/17	TY	95
T1719	Doksuki	9/12-9/15	TY	80

Note: Based on information from the RSMC Tokyo-Typhoon Center.
1) Intensity classification for tropical cyclones
TS: tropical storm, STS: severe tropical storm, TY: typhoon
2) Estimated maximum 10-minute mean wind

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[1] Here, a TC is defined as a tropical cyclone with a maximum sustained wind speed of 34 knots or more.

OLR index data (Table 2) indicate that the overall activity of the Asian summer monsoon (represented by the SAMOI (A) index) was below normal in June and was above normal in July and October. The most active convection area was shifted northward of its normal position in June and October (see the SAMOI (N) index.) and eastward in October (see the SAMOI (W) index.).

In the upper troposphere, the Tibetan High was stronger than normal (Figure 14 (a)). In the lower troposphere, the monsoon trough over Southeast Asia was weaker than normal and anti-cyclonic circulation anomalies straddling the equator were seen over the western Pacific (Figure 14 (b)).

Zonal wind shear between the upper and lower troposphere over the North Indian Ocean and southern Asia (Figure 15) was stronger than normal from the second half of June to the first half of July and from September to the first half of October.

Convective activity over the Maritime Continent was enhanced throughout the summer monsoon season and suppressed over the Philippines from early to mid-August (Figure 16). During this period, the Pacific High did not exhibit its usual extension to mainland Japan and was shifted southward of its normal position, corresponding to the negative PJ (Pacific – Japan) pattern (Nitta 1987; Kosaka and Nakamura 2010) (Figure17).

(Section 1 and 2: Kenji Kamiguchi, 3: Hiroki Togawa, Climate Prediction Division)

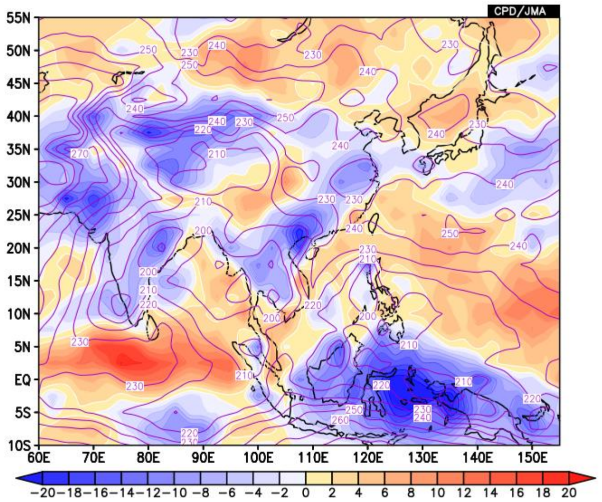


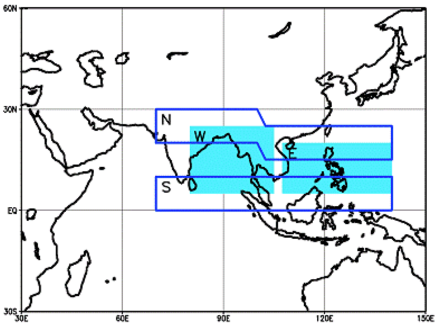
Figure 13 Four-month mean OLR and its anomaly for June–September 2017

The contours indicate OLR at intervals of 10 W/m2, and the color shading denotes OLR anomalies from the normal (i.e., the 1981–2010 average). Negative (cold color) and positive (warm color) OLR anomalies show enhanced and suppressed convection compared to the normal, respectively. Original data are provided by NOAA.

Table 2 Summer Asian Monsoon OLR Index (SAMOI) values observed from May to October 2017

Asian summer monsoon OLR indices (SAMOI) are derived from OLR anomalies from May to October. SAMOI (A), (N) and (W) indicate the overall activity of the Asian summer monsoon, its northward shift and its westward shift, respectively. SAMOI definitions are as follows: SAMOI (A) = (-1) × (W + E); SAMOI (N) = S – N; SAMOI (W) = E – W. W, E, N and S indicate area-averaged OLR anomalies for the respective regions shown in the figure on the right normalized by their standard deviations.

	Summer Asian Monsoon OLR Index (SAMOI)		
	SAMOI (A): Activity	SAMOI (N): Northward-shift	SAMOI (W): Westward-shift
May 2017	0.7	-0.7	0.4
Jun. 2017	-1.1	1.0	0.3
Jul. 2017	1.7	0.8	-0.7
Aug. 2017	-0.8	-0.2	0.8
Sep. 2017	0.3	-0.9	0.2
Oct. 2017	1.2	1.4	-1.1



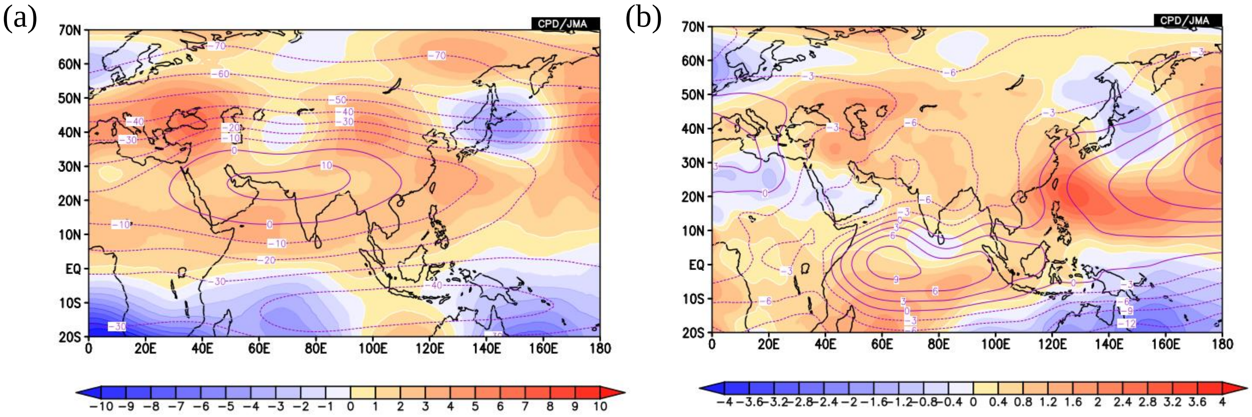


Figure 14 Four-month mean stream function and its anomaly for June – September 2017

(a) The contours indicate the 200-hPa stream function at intervals of 10 × 106 m2/s, and the color shading indicates 200-hPa stream function anomalies from the normal. (b) The contours indicate the 850-hPa stream function at intervals of 4 × 106 m2/s, and the color shading indicates 850-hPa stream function anomalies from the normal. The base period for the normal is 1981 – 2010. Warm (cold) shading denotes anticyclonic (cyclonic) circulation anomalies in the Northern Hemisphere, and vice-versa in the Southern Hemisphere.

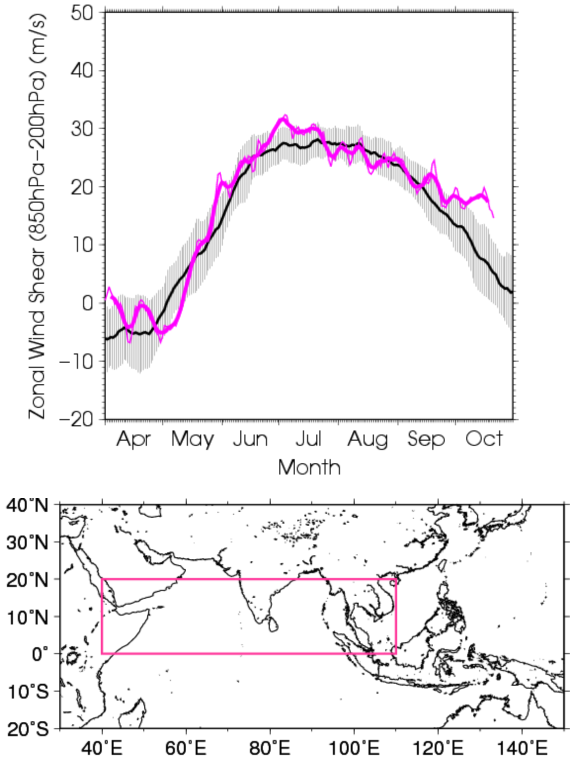


Figure 15 Time-series representation of the zonal wind shear index between 200-hPa and 850-hPa averaged over the North Indian Ocean and southern Asia (the region enclosed by the pink rectangle in the right figure: equator – 20°N, 40°E – 110°E)

The zonal wind shear index is calculated after Webster and Yang (1992). The thick and thin pink lines indicate seven-day running mean and daily mean values, respectively. The black line denotes the normal (i.e., the 1981 – 2010 average), and the gray shading shows the range of the standard deviation calculated for the time period of the normal.

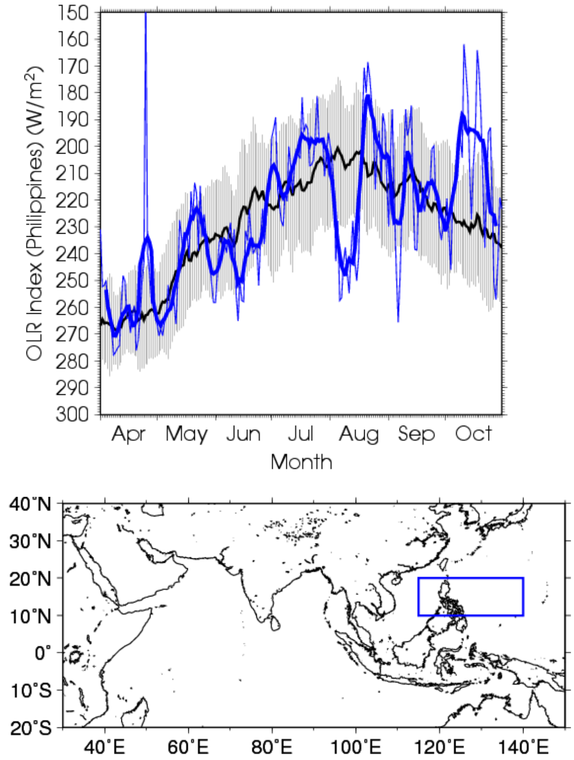


Figure 16 Time-series representation of OLR (W/m2) averaged over the Philippines (shown by the rectangle on the bottom: 10°N - 20°N, 115°E - 140°E)

The OLR index is calculated after Wang and Fan (1999). The thick and thin blue lines indicate seven-day running mean and daily mean values, respectively. The black line denotes the normal (i.e., the 1981 - 2010 average), and the gray shading shows the range of the standard deviation calculated for the time period of the normal.

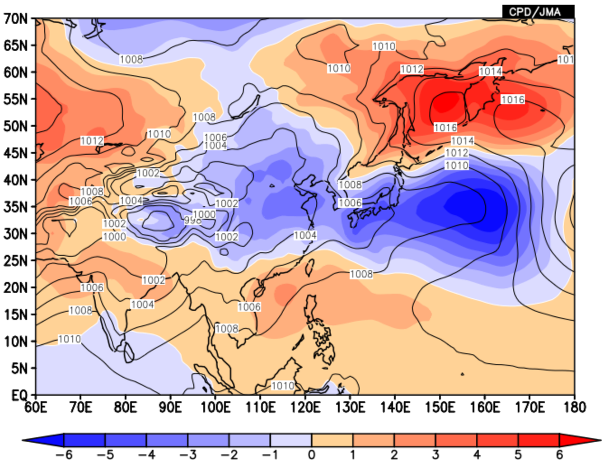


Figure 17 Sea level pressure (contour) and anomaly (shade) for 01-20 August 2017
The contours indicate sea level pressure at intervals of 2 hPa, and the color shading denotes sea level pressure anomalies from the normal (i.e., the 1981–2010 average).

Status of the Antarctic Ozone Hole in 2017

The Antarctic ozone hole in 2017 was less than 20 million square kilometers in size, representing the smallest coverage for 29 years.

Since the early 1980s, the Antarctic ozone hole has appeared every year in austral spring with a peak in September or early October. It is generally defined as the area in which the total ozone column value is below 220 m atm-cm.

According to JMA's analysis based on data from the Ozone Monitoring Instrument (OMI) on the Aura platform, the Antarctic ozone hole in 2017 appeared early in August and expanded rapidly from late August to early September, and then disappeared in mid-November staying smaller than its most recent decadal average during this time (Figure 18, upper left). Its maximum coverage of 18.8 million square kilometers (observed on 11 September) was the first below 20 million square kilometers for 29 years (Figure 18, upper right). The polar vortex over Antarctica was unstable and small in 2017, and the stratospheric temperature was much higher than the most recent decadal average after mid-August. This resulted in reduced formation of polar stratospheric clouds (PSCs), which play an important role in ozone destruction, and may have contributed the reduced scale of the year's ozone hole.

The ozone layer acts as a shield against ultraviolet radiation, which can cause skin cancer. The ozone hole first appeared in the early 1980s and reached its maximum size of 29.6 million square kilometers in 2000. The Antarctic ozone hole significantly affects the Southern Hemisphere surface climate in summer and is expected to continue to appear at least until the middle of this century according to WMO/UNEP Scientific Assessment of Ozone Depletion: 2014 Assessment for Decision-Makers. Close observation of the ozone layer on a global scale should remain a priority for some time.

(Itaru Uesato, Ozone Layer Monitoring Center)

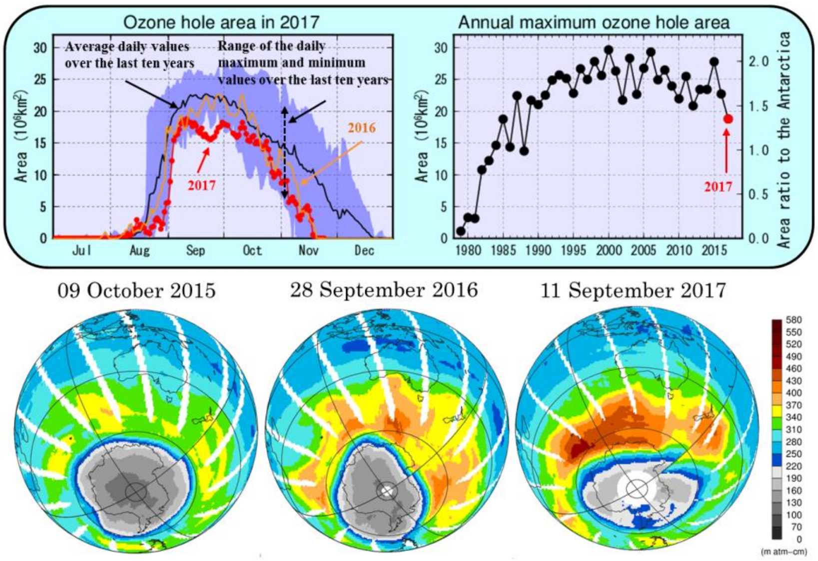


Figure 18 Characteristics of the Antarctic ozone hole
Upper left: Time-series representation of the daily ozone-hole area for 2017 (red line) and the 2007–2016 average (black line). The blue shading area represents the range of daily minima and daily maxima over the past 10 years. Upper right: Interannual variability in the annual maximum ozone-hole area. Bottom: Snapshots of total column ozone distribution on the day of the annual maximum ozone hole area for the last three years; the ozone hole is shown in gray. These panels are based on data from NASA satellite sensors of the Ozone Monitoring Instrument (OMI).

Unusual weather conditions in Japan during the first half of August 2017

- **During the first half of August 2017, the Pacific side of northern Japan experienced shorter-than-normal sunshine durations and cooler-than-normal conditions, and the Pacific side of eastern Japan also experienced shorter-than-normal sunshine durations. These unseasonable weather conditions were caused by the Okhotsk High persisting from the end of July and bringing cool and wet northeasterly airflow to the Pacific side of northern and eastern Japan.**

- **During the same period, warmer-than-normal conditions persisted in Okinawa/Amami in association with the North Pacific Subtropical High shifting southward of its normal position, corresponding to the Pacific-Japan (PJ) pattern with suppressed convective activity over the Philippines.**

1. Climatic characteristics (Figure 19, Table 3)

In the first half of August 2017, cloudy and rainy conditions were prominent on the Pacific side of northern and eastern Japan. This led to below-normal sunshine durations in these regions and below-normal temperatures, especially in northern Japan. During the period from 1 to 16 August, the ratio of the sunshine duration to the normal averaged over the Pacific side of northern Japan was 42% (lowest all-August figure since records began in 1946: 58% (1998)), representing a significant lack of sunshine in the region. In addition, the mean temperature anomaly was -1.9°C (lowest all-August monthly mean temperature anomaly since records began in 1946: -3.6°C (1980)).

Meanwhile, warmer-than-normal conditions persisted in the area from western Japan to Okinawa/Amami during the period. The mean temperature averaged over Okinawa/Amami was +1.5°C, resulting in significantly hot conditions in the region for this period (highest all-August mean temperature anomaly since records began in 1946: +1.2°C (1998)).

2. Characteristic atmospheric circulation causing Japan's weather conditions (Figures 20 and 21)

(1) Shorter-than-normal sunshine durations and cooler-than-normal conditions on the Pacific side of northern Japan and shorter-than-normal sunshine durations on the Pacific side of eastern Japan

The Okhotsk High, which occasionally emerges for several days near the surface over the Sea of Okhotsk (usually during summer) has persisted since the end of July, bringing cool wet northeasterly flows to the Pacific side of northern and eastern Japan. Typhoon Noru passed over and around the islands of Japan in early August, after which low-pressure systems passed repeatedly over mainland Japan in association with the southward shift of the westerly jet from its normal position and a weaker-than-normal northwestward extension of the North Pacific Subtropical High (NPSH). These atmospheric circulations increased the number of cloudy and rainy days on the Pacific side of northern and eastern Japan.

The persistence of the Okhotsk High is presumed to be mainly due to blocking-high development over the Sea of Okhotsk in association with the meandering westerly jet stream over northern Eurasia.

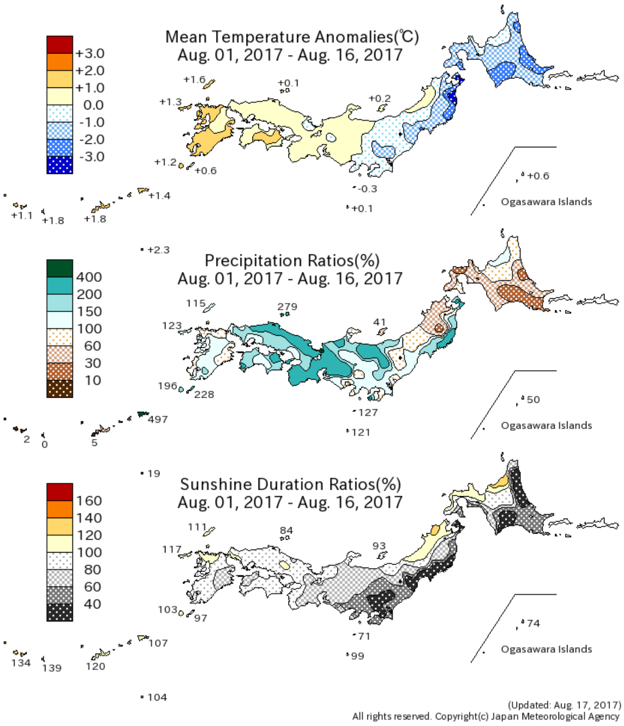


Figure 19 Mean temperature anomalies, precipitation ratios and sunshine duration ratios for the period from 1 to 16 August 2017

The base period for the normal is 1981 – 2010.

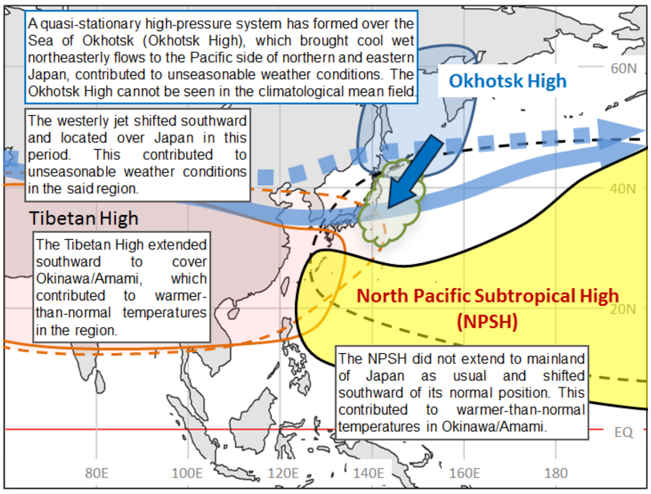
Table 3 Regional averages of mean temperature anomalies and sunshine duration ratios for the period from 1 to 16 August 2017

		Mean temperature anomaly (°C)	Sunshine duration ratio (%)
Northern Japan	Sea of Japan side	-0.8	97
	Pacific side	-1.9	42
Eastern Japan	Sea of Japan side	+0.1	84
	Pacific side	-0.2	57
Western Japan	Sea of Japan side	+0.8	91
	Pacific side	+0.8	88
Okinawa/Amami		+1.5	118

(2) Warmer-than-normal conditions in Okinawa/Amami

Throughout the first half of August, the NPSH did not extend to mainland Japan as usual and shifted southward of its normal position, corresponding to the Pacific-Japan (PJ) pattern (Nitta 1987; Kosaka and Nakamura 2010) with suppressed convective activity over and around the Philippines. This anomalous atmospheric circulation in the lower troposphere caused longer-than-normal sunshine durations, adiabatic heating associated with stronger-than-normal subsidence and westerly warm air inflow, thereby contributing to significantly warm conditions in Okinawa/Amami. The Tibetan High in the upper troposphere extended southward to cover Okinawa/Amami. This is also presumed to be related to the warm conditions over the area.

This NPSH enhancement is considered to have been caused by suppressed convective activity over and around the Philippines, which is likely to be associated with the intraseasonal variability of the tropical atmosphere.



A quasi-stationary high-pressure system has formed over the Sea of Okhotsk (Okhotsk High), which brought cool wet northeasterly flows to the Pacific side of northern and eastern Japan, contributed to unseasonable weather conditions. The Okhotsk High cannot be seen in the climatological mean field.

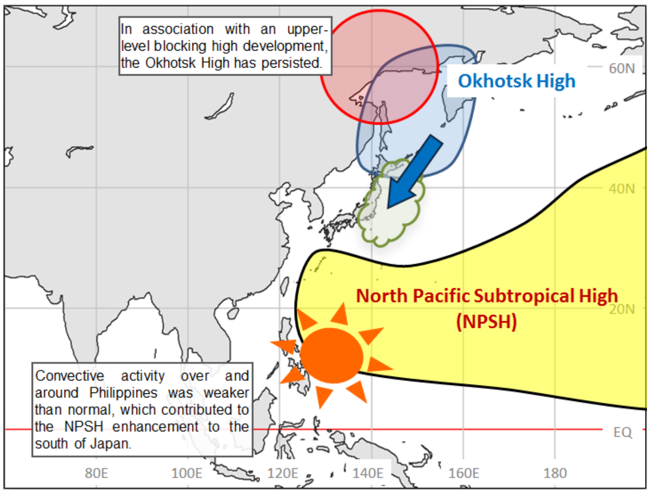
The westerly jet shifted southward and located over Japan in this period. This contributed to unseasonable weather conditions in the said region.

The Tibetan High extended southward to cover Okinawa/Amami, which contributed to warmer-than-normal temperatures in the region.

The NPSH did not extend to mainland of Japan as usual and shifted southward of its normal position. This contributed to warmer-than-normal temperatures in Okinawa/Amami.

Figure 20 Primary factors contributing to the unseasonable weather conditions observed during the first half of August 2017

Solid lines show elements for 2017, and dashed lines show the normal.



In association with an upper-level blocking high development, the Okhotsk High has persisted.

Convective activity over and around Philippines was weaker than normal, which contributed to the NPSH enhancement to the south of Japan.

Figure 21 Primary factors contributing to the sustainment of the Okhotsk High and the strong expansion of the Pacific High to the south of Japan during the first half of August 2017

TCC contributions to Regional Climate Outlook Forums

WMO Regional Climate Outlook Forums (RCOFs) bring together national, regional and international climate experts on an operational basis to produce regional climate outlooks based on input from participating NMHSs, regional institutions, Regional Climate Centers and global producers of climate predictions. By providing a platform for countries with similar climatological characteristics to discuss related matters, these forums ensure consistency in terms of access to and interpretation of climate information.

In autumn 2017, TCC dispatched experts to SASCOF-11, provided seasonal forecast materials to ASEANCOF-9 and NEACOF-13, and sent two expert representatives to a WMO-coordinated Workshop on global review of RCOFs in September.

SASCOF

The Maldives Meteorological Department (MMD) hosted the 11th winter session of the South Asian Climate Outlook Forum (SASCOF-11) from 25 to 27 September 2017 in Malé, Maldives. The forum was supported by WMO and the Regional Integrated Multi-hazard Early-warning System for Africa and Asia (RIMES) with funding from the Government of Canada. More than 50 people attended the event to discuss climatic conditions for the upcoming winter monsoon season (Oct. 2017 to Feb. 2018).

As part of the activities of WMO's Global Producing Centers for Long-range Forecast (GPC-LRFs), Takuya Komori from GPC Tokyo provided a winter monsoon outlook based on JMA's dynamical seasonal ensemble prediction system with probabilistic information on atmospheric variability and the evolution of conditions in the tropical Pacific and Indian Ocean for winter 2017/2018. The information was intended to support country-scale outlooks from NMHSs in South Asia and a consensus outlook for South Asia.

At the forum, attendees discussed their experience of using climate information, with Mr. Komori contributing to promote better use of climate services through future SASCOF activities.

WMO Workshop on Global Review of RCOFs

The WMO Workshop on Global Review of RCOFs, held from 5 to 7 September 2017 in Guayaquil, Ecuador, provided a detailed review of current processes at various RCOFs in order to highlight related gaps and provided a platform for ideas toward more effective and sustainable provision of climate products/services for decision-making. More than 40 experts from international organizations involved in RCOF processes (including representatives from the Regional Climate Center (RCC), GPC-LRF and the Lead Center for LRF Multi-Model Ensemble (LC-LRFMME)) attended, with two TCC experts contributing to discussions on aspects of RCOF operations from regional and global-center viewpoints.

The final report of the workshop is available on the meeting website, and the event's outcomes and recommendations are expected to help organizations involved in RCOF operations to improve related implementation.

(SASCOF-11: Takuya Komori: Tokyo Climate Center,
WMO Workshop on Global Review of RCOFs:
Shoji Hirahara and Yasushi Mochizuki, Tokyo Climate Center)

The Fifth Session of the East Asia winter Climate Outlook Forum (EASCOF-5)

The World Meteorological Organization (WMO) actively supports the activities of the Regional Climate Outlook Forum (RCOF), which brings together experts from climatologically homogeneous regions and provides consensus-based seasonal predictions and information. As one of the RCOFs, the East Asia Winter Climate Outlook Forum (EASCOF) was jointly established by the China Meteorological Administration (CMA), the Japan Meteorological Agency (JMA), the Korea Meteorological Administration (KMA), and Mongolia's National Agency for Meteorology and Environment Monitoring (NAMEM) in 2012.

The fifth session of EASCOF (EASCOF-5) was held at JMA's headquarters in Tokyo, Japan, from 8 to 10 November 2017. More than 30 experts from China, Japan, Mongolia and the Republic of Korea attended the event, sharing information on the current status of and future plans for seasonal forecasting services in individual National Meteorological and Hydrological Services (NMHSs). The attendees also discussed recent understandings of phenomena related to seasonal prediction of the East Asian Winter Monsoon (EAWM) and seasonal outlooks for the coming winter. A new session providing a platform for discussion of good practices toward user involvement in climate services was also held to encourage NMHS efforts in the promotion of climate service utilization. At the session, attendees from each NMHS talked about their current efforts to promote the utilization of climate information in collaboration with specific sectors, including those of agriculture, energy and water resources. Invited speakers from the agricultural sector also gave presentations on how climate information had benefitted them, and the attendees engaged in active discussions. Exchanges of knowledge in this three-day forum are expected to help develop attendees' understanding of phenomena related to EAWM and support improvement of their climate services.

Forum materials are available on the EASCOF portal.

(Atsushi Minami, Tokyo Climate Center)

Attendees with JMA Global Environment and Marine Department Director-General Shogo Tanaka

Update of website on RA II Information Sharing for Climate Services

Climate services today play increasingly important roles in helping various socio-economic sectors to reduce related negative impacts and adapt to climate change and global warming. Against such a background, National Meteorological and Hydrological Services (NMHSs) need to provide high-quality, high-precision climate information in consideration of accessibility and user needs, and engage in various activities related to the Global Frameworks for Climate Services (GFCS) initiative to promote utilization of climate information in user sectors.

For the improvement of climate services and the successful implementation of GFCS, it is important to share information on the services, good practices and lessons learned in climate-related activities, especially among NMHSs in climatologically similar region. However, such important information has not so far been fully shared among NMHSs in WMO Regional Association II (RA II).

In response to related decisions taken at the 15th and 16th sessions of RA II to improve information sharing on climate services in the region, TCC operates a dedicated website at http://ds.data.jma.go.jp/tcc/RaiiInfoshare/ (see TCC News No.36 for more information).

A July 2017 questionnaire survey conducted by TCC to support updating of the website generated responses from more than 10 countries thanks to the kind cooperation of persons involved. Based on the information provided, the site was refined in October with additions including a clickable map to support usability and accessibility to individual NMHS' information on climate services.

TCC is committed to supporting the improvement of RA II climate services via the operation of the website.

(Atsushi Minami, Tokyo Climate Center)

You can also find the latest newsletter from Japan International Cooperation Agency (JICA).
JICA's World (October 2017)
https://www.jica.go.jp/english/publications/j-world/1710.html
JICA's World is the quarterly magazine published by JICA. It introduces various cooperation projects and partners along with the featured theme. The latest issue features "Refugees and Displaced People Rebuilding the Lives of the Displaced".

Any comments or inquiry on this newsletter and/or the TCC website would be much appreciated. Please e-mail to tcc@met.kishou.go.jp.
(Editors: Kiyotoshi Takahashi, Yasushi Mochizuki and Atsushi Minami)

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