Tokyo Climate Center, Japan Meteorological Agency

TCC News

Winter 2025

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Global temperature for 2024 was the highest since 1891

JMA analysis indicates that the annual anomaly of the global average surface temperature for 2024 (i.e., the combined average of the near-surface air temperatures over land and the sea- surface temperatures) was +0.62°C above the 1991 – 2020 average, and was the warmest on record since 1891 (Figure 1-1).

On a longer time scale, the annual global average surface temperature has risen at a rate of about +0.77°C per century, and 2015 to 2024 were among the warmest decade since 1891 (Table 1-1). These recent high temperatures are thought to be affected by the global warming due to increase in anthropogenic greenhouse gas concentrations including carbon dioxide. In addition, the global averaged surface temperature is affected by inter-annual to decadal natural fluctuations intrinsic to the earth's climate.

High temperature deviations were observed in most parts of the world (Figure 1-2).

JMA monitors monthly, seasonal and annual average anomalies of global surface temperature, with results routinely updated on the TCC website at

https://ds.data.jma.go.jp/tcc/tcc/products/gwp/gwp.html

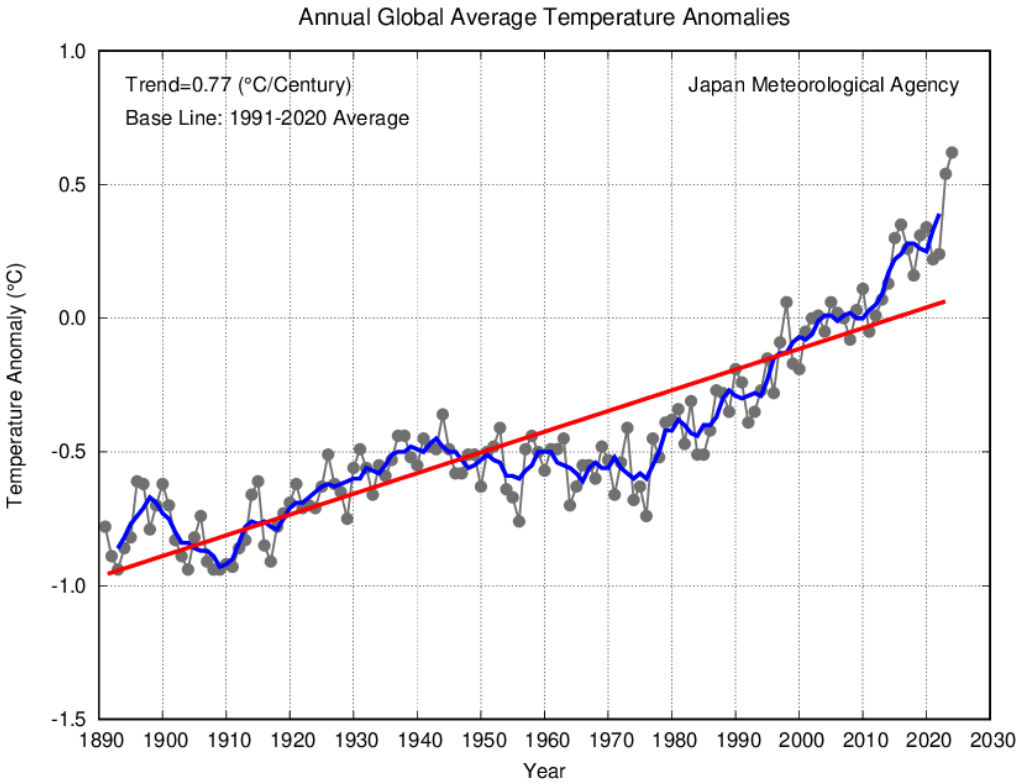

Figure 1-1 Long-term change in annual mean surface temperature anomalies over the globe
Anomalies are derived from the 1991 – 2020 average baseline. The thin black line indicates surface temperature anomalies for each year, while the blue and red lines indicate the related five-year running mean and the long-term linear trend, respectively.

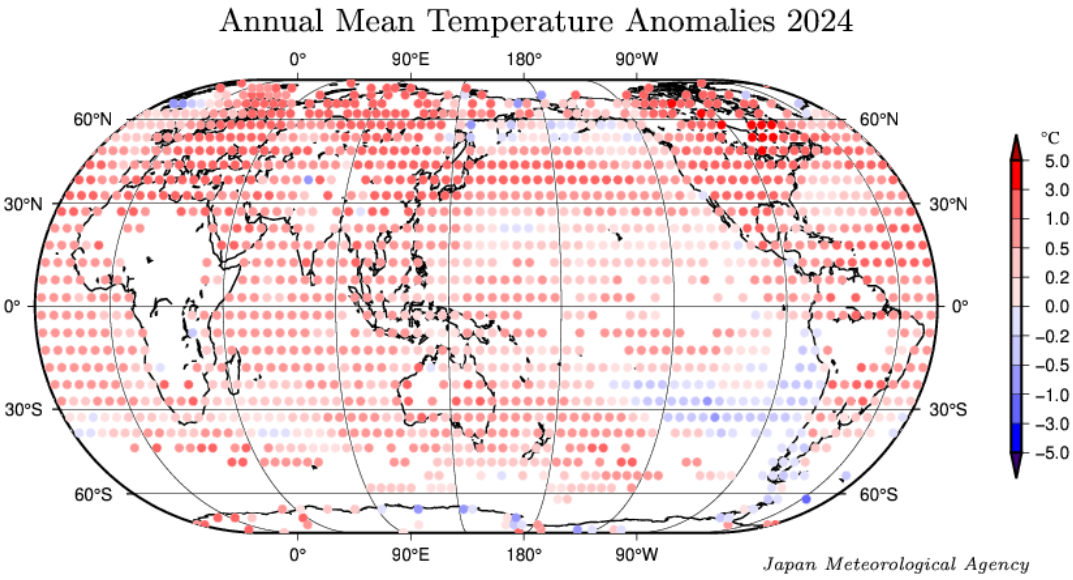

Figure 1-2 Annual mean temperature anomalies
The circles indicate anomalies of surface temperature averaged in 5° x 5° grid boxes. The annual mean global temperature anomaly is determined by averaging the anomalies, derived from the 1991 – 2020 average baseline, of all grid boxes weighted with the grid box area.

Table 1-1 Ranking of annual global average temperatures

Rank	Year	Temperature Anomaly w.r.t. 1991 – 2020 average
1	**2024**	**+0.62**
2	2023	+0.54
3	2016	+0.35
4	2020	+0.34
5	2019	+0.31
6	2015	+0.30
7	2017	+0.26
8	2022	+0.24
9	2021	+0.22
10	2018	+0.16

(ONO Marika, Tokyo Climate Center)

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Highlights of the Global Climate in 2024

Annual mean temperatures were above normal in most parts of the world, and very high in East Asia, in Southeast Asia, in South Asia, in the Middle East, from Western Russia to Europe, from Northern Africa to the southwestern part of Western Africa, in North America except Alaska and western Canada, from Central America to northern South America, in central South America and from Melanesia to the Australian coast. (Figure 2-1a).

Extremely high temperatures were frequently observed in areas where the annual mean temperatures were very high. (Figure 2-2 and map for details).

Annual precipitation amounts were above normal in northern East Asia, from Central Asia to South Asia, in the coastal areas of the Arabian Peninsula, from northern to central Europe, from the Caribbean countries to eastern Mexico, and in eastern Brazil, and below normal in northwestern Northern Africa and in northwestern Mexico (Figure 2-1b).

Extremely high precipitation amounts were frequently observed in eastern China, in eastern Indonesia, in southern India, in the western part of Western Africa and in northern Chile. Extremely low precipitation amounts were frequently observed in northwestern Eastern Siberia, in northern Madagascar and in northern Brazil (Figure 2-1b and map for details).

Major extreme climatic events and weather–related disasters occurring in 2024 are listed below (Table 2-1, see also Figure 2-2). Further details are provided in the Annual Report on Global Extreme Climate Events in 2024 on the TCC website.

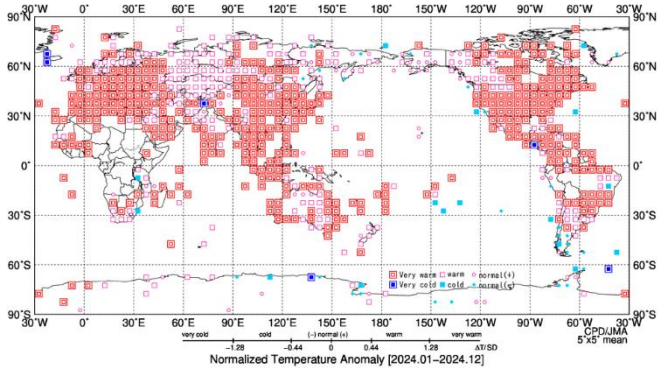

Figure 2-1a Normalized annual mean temperature anomalies for 2024

Categories are defined by the annual mean temperature anomaly against the normal divided by its standard deviation and averaged in 5° × 5° grid boxes. The thresholds of each category are –1.28, –0.44, 0, +0.44 and +1.28. The normal values and standard deviations are calculated from 1991 – 2020 statistics. Land areas without graphics represent regions for which the observation data sample is insufficient or normal data are unavailable.

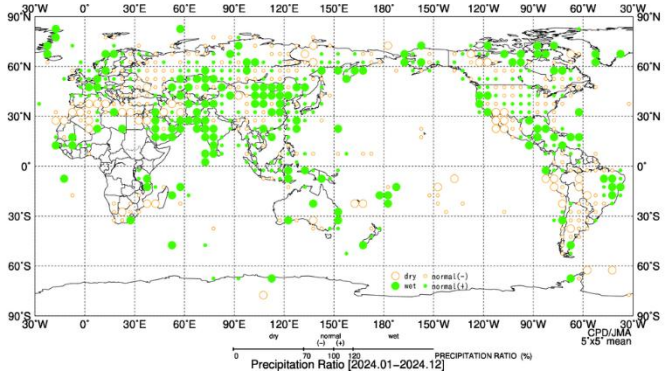

Figure 2-1b Annual total precipitation ratios for 2024

Categories are defined by the annual precipitation ratio to the normal averaged in 5° × 5° grid boxes. The thresholds of each category are 70, 100 and 120%. Land areas without graphics represent regions for which the observation data sample is insufficient or normal data are unavailable.

Table 2-1 Major extreme climatic events and weather-related disasters worldwide in 2024

	Type	Period	Area
(1)	Warm	February, April, June-October	The eastern part of East Asia
(2)	Typhoon	July, September-October	From southern China to Southeast Asia
(3)	Warm	January-April, July-November	Southeast Asia
(4)	Cold Wave	March	Afghanistan
(5)	Dry	March, May, July, September	In and around Ukraine
(6)	Warm	April, June-August	From the Arabian Peninsula to around the eastern Mediterranean Sea
(7)	Wet	September-October	In and around southern Europe
(8)	Heavy Rain	March-September	From northern Eastern Africa to Western Africa
(9)	Warm	June-October, December	From the western USA to Mexico
(10)	Wet	September	The southeastern USA
(11)	Warm	January-April, September-October	From Central America to northern South America, central South America
(12)	Wildfire	February	Chile
(13)	Cold	May	Southern South America

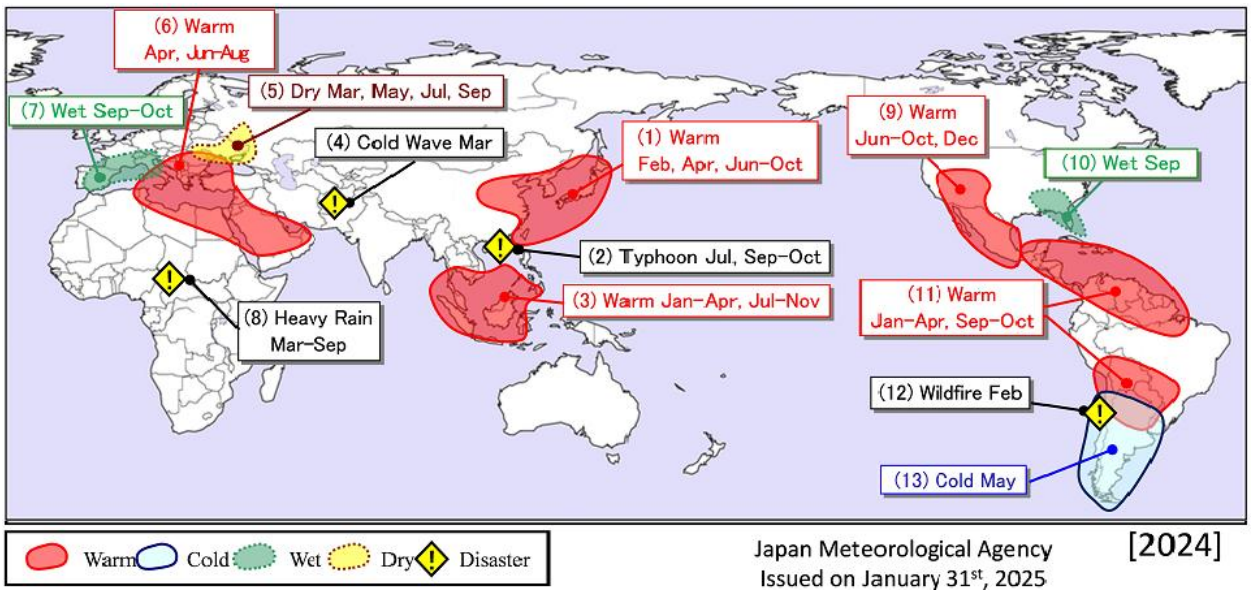

Figure 2-2 Major extreme climate events and weather–related disasters worldwide in 2024
Schematic representation of major extreme climate events and weather–related disasters occurring during the year.

(UMEZU Hironori, Tokyo Climate Center)

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Summary of Japan's climatic characteristics for 2024

– **Annual mean temperatures were significantly above normal throughout Japan, with record levels in astern/Western Japan and Okinawa/Amami.**

Warm air covered Japan for most of the year, resulting in significantly above-normal annual mean temperatures nationwide. The annual mean over Japan as a whole was the highest since 1898, exceeding the previous record set in 2023. The regional averages of annual mean temperature anomalies were the highest on record since 1946 in Eastern/Western Japan and Okinawa/Amami. These areas experienced the highest or joint-highest seasonal mean temperatures for summer and autumn. Among 153 weather stations nationwide, 80 (including 21 tie records) in summer and 120 (including 4 tie records) in autumn had the highest mean temperatures on record for those seasons.

– **Annual sunshine durations were significantly above normal in Northern Japan, while annual precipitation amounts were significantly above normal on the Sea of Japan side of Eastern Japan, the Pacific side of Eastern Japan and in Okinawa/Amami.**

High-pressure systems were often observed over Northern Japan and there were many sunny days, resulting in significantly above-normal annual sunshine durations there. These were also above normal in Eastern/Western Japan. Annual precipitation amounts were below normal on the Pacific side of Northern Japan but significantly above normal in Eastern Japan and Okinawa/Amami because of susceptibility to fronts and typhoons during certain periods. Annual precipitation amounts were also above normal on the Sea of Japan side of Northern Japan and in Western Japan.

In the Tokai region, where precipitation amounts were significantly above normal in spring and summer, the annual amount tied with 1998 since 1946.

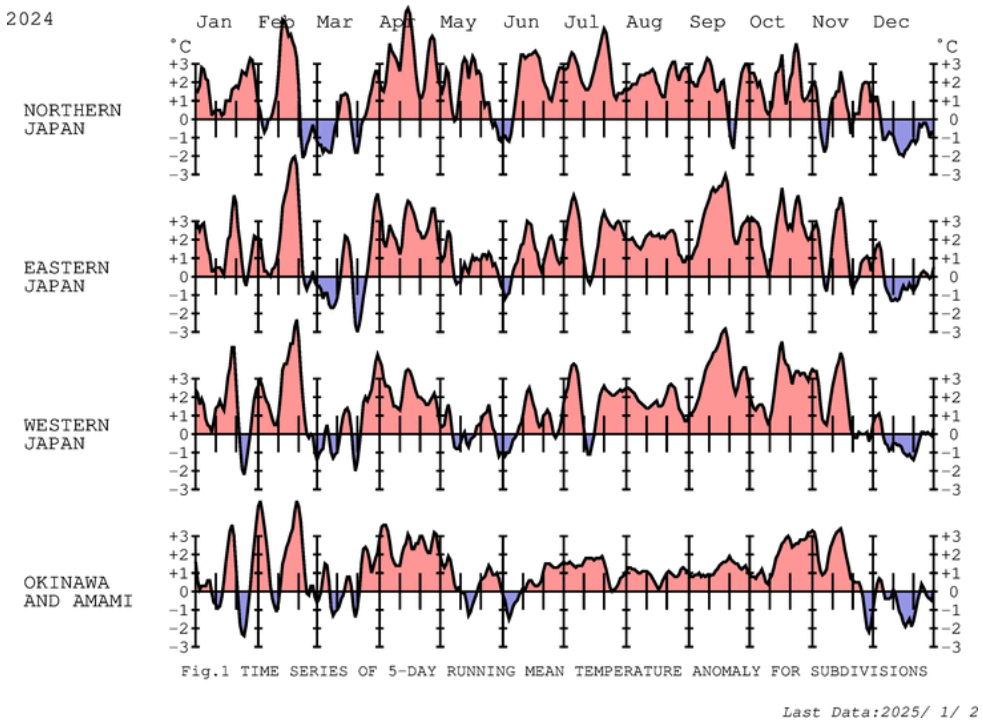

Figure 3-1 Time-series representations of five-day running mean temperatures (Jan. – Dec. 2024)

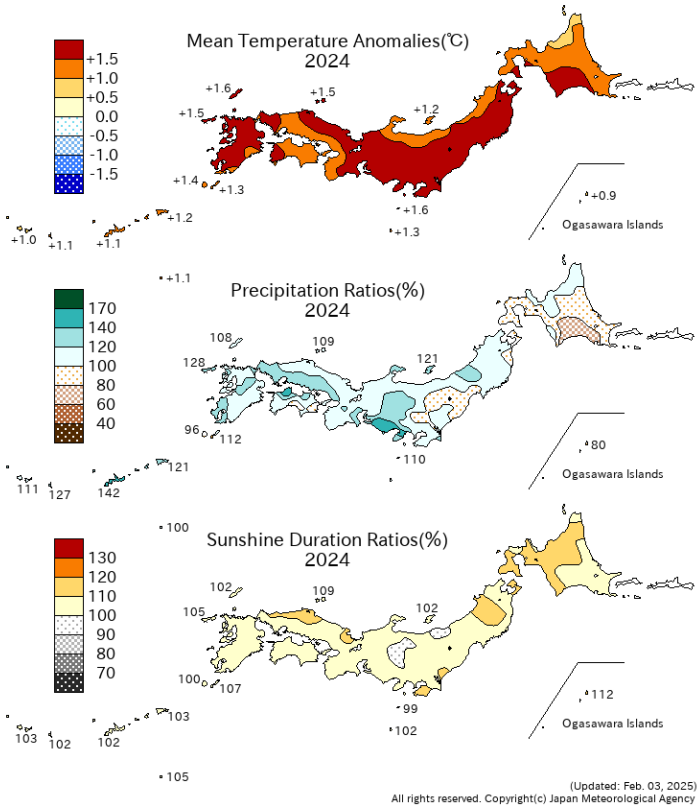

Figure 3-2 Annual climate anomalies/ratios for Japan in 2024

(HIRAI Masayuki, Tokyo Climate Center)

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TCC Training Seminar on ENSO/IOD and Regional Impact

JMA's Tokyo Climate Center (TCC) has assisted National Meteorological and Hydrological Services (NMHSs) in improving climate services since 2008, providing basic climate data, products and tools to NMHSs online and assisting their capacity development in the Asia-Pacific region. TCC holds annual training seminar as part of these activities in its role as an RCC in the WMO RA II area, and arranges expert visits to NMHSs to promote the effective transfer of technology and discuss potential support for climate services.

In this context, the Center held 2025 training seminar on ENSO/IOD and related regional impactss on 15 – 16 January (online) and 21 – 24 January (in person at JMA headquarters) with 12 attendees from NMHSs in Bangladesh, Bhutan, Hong Kong (China), Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand and Vietnam. The seminar focused on expertise with the climate system and analysis of impacts from oceanic variability (such as ENSO/IOD) on regional atmospheric conditions using the Interactive Tool for Analysis of the Climate System (iTacs). All participants gave presentations at the end regarding ENSO/IOD's impacts on the climates of their respective countries and engaged in fruitful discussions with TCC staff.

The training contents are available on the TCC website at
https://www.data.jma.go.jp/tcc/tcc/library/library2024.html.

Photo 4-1: Attendees with JMA Atmospheric and Oceanic Department Director-General Yoshihiko Tahara and other TCC staff

Photo 4-2: Attendees on a courtesy visit to JMA Director-General Ryoichi Nomura

Photo 4-3: Presentations and practical exercises at the seminar

(HARADA Masashi and TAKAHASHI Kiyotoshi, Tokyo Climate Center)

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TCC Activity Report for 2024

In 2024, the Tokyo Climate Center (TCC) continued to support Asia-Pacific National Meteorological and Hydrological Services (NMHSs) by providing and enhancing data and products, holding training seminars, publishing quarterly newsletters and participating in international meetings.

1. Enhancement of online data/products/tools

1.1 Special reports on extreme events

In a mandate role as a WMO Regional Climate Centre (RCC) in Regional Association II (RA II), TCC monitors world climate conditions with focus on Asia and its surrounding area. The Center issues reports on extreme climate events and summaries of the Asian summer/winter monsoon on its website (https://www.data.jma.go.jp/tcc/tcc/products/clisys/reports/index.html).

Record-high temperatures were observed nationwide in Japan in July 2024, with the national average even exceeding the previous July 2023 record. This situation persisted into August, with unprecedented temperatures in western Japan. Heavy rainfall was observed in northern Japan in late July, with the second-highest-ever levels on the Sea of Japan side.

In this context, the Japan Meteorological Agency (JMA), with the help of the Advisory Panel on Extreme Climatic Events (see TCC News No. 9), investigated atmospheric and oceanic conditions considered to have contributed to such climate extremes and summarized related primary factors. A comprehensive report is available at https://www.data.jma.go.jp/tcc/data/news/press_20241018.pdf (TCC News No. 78).

An expert of TCC investigated the contribution of an unprecedented marine heatwave to the extremely hot summer conditions observed over northern Japan in 2023 (see https://www.data.jma.go.jp/tcc/data/news/press_20240815.pdf, TCC News No. 77).

1.2 Pilot launch of Seasonal Tropical Cyclone Forecast Products

In its role as a WMO Regional Climate Center, TCC began experimentally providing products for seasonal forecasting of tropical cyclones reaching tropical storm intensity or higher for the western North Pacific to support WMO Members in the Asia/Pacific region. Registered users within NMHSs can access these products via the TCC website (see TCC News No. 76).

1.3 Launch of TCC experimental Three-month Guidance Tool

TCC's interactive Three-month Guidance Tool was released as an extension of its one-month version (TCC News No. 56), simplifying calculation of statistical guidance for any given station point and supporting operational seasonal forecasts (see TCC News No. 77).

2. Capacity development

TCC conducts annual training seminar as part of capacity-development activities related to its role as an RCC in RA II. It also arranges expert visits to and hosts visitors from NMHSs to support discussions on climate services and effective transfer of technology.

2.1 Training seminar

TCC holds training each fiscal year (i.e., April to March). The Center held a seminar on seasonal forecasting from 29 January to 2 February 2024, with in-person attendance for the first time in four years following COVID-19. Details are reported in TCC News No. 75.

2.2 Expert visits

TCC experts visited the National Center for Hydrology and Meteorology (NCHM) of Bhutan from 6 to 8 August 2024 as part of the JICA (Japan International Cooperation Agency) Project for Capacity Enhancement of Meteorological Observation, Forecasting and Flood Warning for Disaster Preparedness and Response in the Thimphu and Paro River Basins. This included related capacity development by TCC in its WMO Regional Climate Center role (see TCC News No. 77).

Content encompassed training on medium-to-long range forecasts and the effective use of TCC resources,

including the online Interactive Tool for Analysis of the Climate System (iTacs; see TCC News No. 71) and TCC's Three-month Guidance Tool launched in July 2024 (see TCC News No. 77)..

3. International meetings

3.1 Regional climate outlook forums

RCCs are expected to actively contribute to and lead useful discussions in Regional Climate Outlook Forums (RCOFs). In 2024, TCC experts participated in the following RCOFs in Asia together with WMC-Tokyo experts:

- 20th session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Regional Association II (FOCRA II-20) in Qingdao, Shandong, China, from 9 to 11 May
- 28th session of the South Asian Climate Outlook Forum (SASCOF-28), in Pune, India, from 29 April to 1 May
- 29th session of the South Asian Climate Outlook Forum (SASCOF-29) online, 25, 26 September and 3 October
- 23rd session of the ASEAN Climate Outlook Forum (ASEANCOF-23) online, from 26 to 29 November
- 12th session of the East Asia winter Climate Outlook Forum (EASCOF-12) in Daejeon, Korea, from 8 to 10 November

TCC attendees gave presentations on seasonal predictions based on JMA's numerical model and participated in discussions toward a consensus on regional forecasts at SASCOF-28. Representatives also highlighted a new experimental product for seasonal tropical cyclone forecasting at SASCOF-29.

4. Publications

TCC has published its newsletter (TCC News) on a quarterly basis since 2005. The publication is intended to enhance communication and provide information to NMHSs and related communities about recent TCC developments, events and activities as well as details of the Center's reports on the state of the climate, monitoring results and outlooks. In 2024, TCC News No. 75 - 78 were issued and made available on the TCC website.

5. Plans for 2025

- Contribution to the Global Framework for Climate Services (GFCS)

RCCs are expected to play a major role in GFCS implementation. In this context, TCC plans to further strengthen its activities and lead RA II contributions to the framework. These efforts will include the provision of ongoing assistance to NMHSs for better climate services, as well as maintenance of a site for information sharing on climate services in RA II.

- Product/tool provision

The seasonal ensemble forecast system will be updated in the second half of FY 2025, and related TCC products will be changed for use of products from the system.

- Capacity development

TCC will host a dozen experts at its annual training seminar in the second half of FY 2025, and will continue to dispatch experts to NMHSs as necessary and host visitors from NMHSs upon request.

(TAKAHAHI Kiyotoshi, Tokyo Climate Center)

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TCC and WMC Tokyo co-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 Centres (RCCs) 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 2024, representatives from TCC and the World Meteorological Centre (WMC) Tokyo attended the 23rd session of the ASEAN Climate Outlook Forum (ASEANCOF-23) online from 26 to 29 November. WMC Tokyo staff gave presentations on outlooks based on model predictions.

Specifically, winter outlooks were provided based on climate monitoring and forecast products from the TCC website, highlighting Copernicus Climate Change Service (C3S) multi-model ensemble prediction incorporating JMA seasonal projections.

In response to the question of why winter atmospheric circulation is expected to follow the La Niña trend, it was stated that ocean conditions are likely to remain normal. Although these conditions are more likely not to meet the criteria for a La Niña event, the characteristics of such a phenomenon may appear and the atmosphere will respond accordingly.

These activities are intended to support the output of country-scale outlooks by National Meteorological and Hydrological Services (NMHSs), and to contribute to the summarization of consensus outlooks as well as the reduction of climate disaster risk in the water, agriculture and health sectors for each target area. TCC and WMC Tokyo are committed to ongoing collaboration with operational climate communities to enhance progress in forecast skill and application of climate information toward the resolution of common issues and the realization of a world resilient to adverse climate conditions.

(HARADA Masashi, TAKAHASHI Kiyotoshi, Tokyo Climate Center and SATO Hitoshi, WMC-Tokyo)

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You can find the latest newsletter from the Japan International Cooperation Agency (JICA).
JICA Magazine
https://jicamagazine.jica.go.jp/en/
"JICA magazine" is a public relations magazine published by JICA. It introduces the current situations of developing countries around the world, the people who are active in the field, and the content of their activities.

Any comments or inquiry on this newsletter and/or the TCC website would be much appreciated.
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