Tokyo Climate Center, Japan Meteorological Agency

TCC News

Winter 2020

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Global surface temperature for 2019 was the second highest since 1891

JMA analysis indicates that the annual anomaly of the global average surface temperature for 2019 (i.e., the combined average of the near-surface air temperature over land and the sea surface temperature) was +0.43°C above the 1981 – 2010 average, making it the second-warmest year since 1891 (Figure 1-1).

On a longer time scale, the annual global average surface temperature has been rising at a rate of about 0.74°C per century. The years from 2015 to 2019 were the top-five warmest on record in terms of global temperature, and nine of the ten warmest have occurred during this century (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. The weak El Niño conditions seen until spring 2019 may have contributed to the high global temperatures.

High temperature deviations were particularly evident over wide areas of Europe, East Asia and Australia, and over the North Pacific and the Indian Ocean (Figure 1-2).

JMA monitors monthly, seasonal and annual average anomalies of global surface temperature. Those results are routinely updated on the following TCC website:
https://ds.data.jma.go.jp/tcc/tcc/products/gwp/gwp.html

(Kato Nao, Tokyo Climate Center)

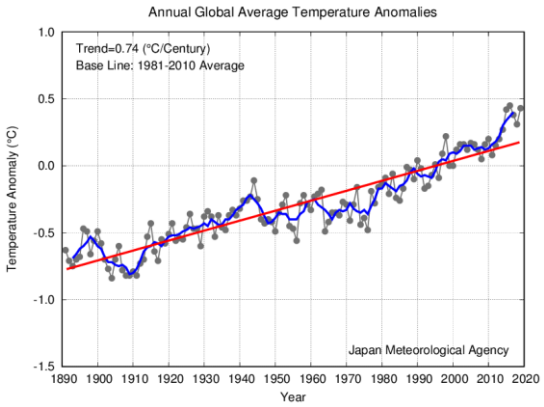

Figure 1-1 Long-term change in worldwide annual mean surface temperature anomalies

The black line with filled circles indicates anomalies of 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 represented as deviations from the 1981 – 2010 average.

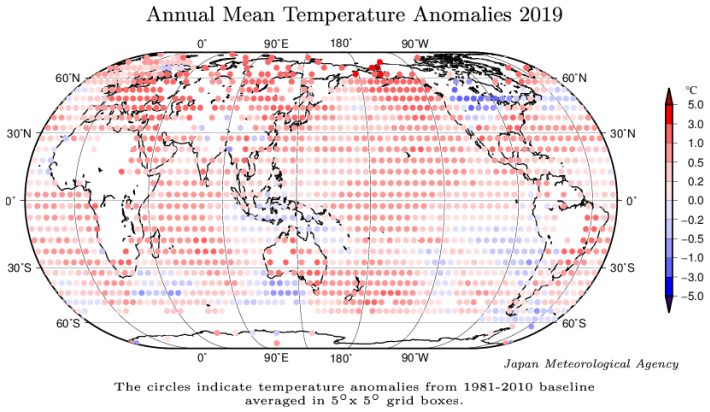

Figure 1-2 Annual mean temperature anomalies in 2019

The circles indicate anomalies of surface temperature averaged in 5° x 5° grid boxes. Anomalies are deviations from the 1981 – 2010 average.

Table 1-1 Ranking of annual global average temperatures

Rank	Year	Temperature Anomaly w.r.t. 1981 – 2010 average
1	2016	+0.45
2	2019	+0.43
3	2015	+0.42
4	2017	+0.38
5	2018	+0.31
6	2014	+0.27
7	1998	+0.22
8	2013	+0.20
	2010	+0.20
10	2005	+0.17

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Highlights of the Global Climate in 2019

Annual mean temperatures were above normal in most parts of the world and very high in Siberia, from northeastern to southern East Asia, in Southeast Asia, in the southern part of South Asia, in Central Asia, in the Middle East, from central to southern Europe, from the eastern part of Eastern Africa to Southern Africa, in Alaska, from southern North America to Central America, from northern to eastern South America, and in Australia. Values were below normal in central North America (Figure 2-1).

Extremely high temperatures were observed from Mauritius to South Africa throughout the year, and were frequently observed for seven months or more from southern East Asia to central Southeast Asia, from southern India to Sri Lanka, in and around southern Europe, from the eastern USA to the northwestern part of South America, in and around Brazil, and in Australia (Figure 2-3).

Annual precipitation amounts were above normal in South Asia, from the northern Middle East to the northern part of Northern Africa, and in Alaska, the USA and northwestern South America. Values were below normal in the southeastern part of Southeast Asia, western Northern Africa, the southwestern part of South America, and from eastern to central Australia (Figure 2-2). Amounts in 2019 were the second highest in the contiguous USA since 1895 (National Oceanic and Atmospheric Administration, the USA), and were the lowest in Australia since 1900 (Bureau of Meteorology, Australia).

Extremely high precipitation amounts were frequently observed in and around Spain, from midwestern to southeastern parts of the USA, and in/around northeastern Argentina. Extremely low values were frequently observed from the central part of the Malay Peninsula to Java Island, from eastern to central Europe, and in southwestern Canada (Figure 2-3).

Major extreme climatic events and weather–related disasters occurring in 2019 are listed below (also see Figure 2-3). Further details are provided in the Annual Report on Global Extreme Climate Events in 2019 on the TCC website.

(1) Typhoon: from the Pacific side of northern Japan to the Pacific side of eastern Japan (September – October)
(2) Warm: in and around the northeastern part of East Asia (January, March, May, September – October)
(3) Warm: from the northern to central part of Central Siberia (February – March, June – August)
(4) Heavy Rain and Typhoon: from eastern China to northern Thailand (June – August)
(5) Warm: from the southern part of East Asia to the central part of Southeast Asia (January – February, April – November)
(6) Dry: from the central part of the Malay Peninsula to Java Island (June – July, September – November)
(7) Heavy Rain: eastern Indonesia (March)
(8) Heavy Rain: in and around South Asia (July – October)
(9) Warm: from southern India to Sri Lanka (February – July, November – December)
(10) Heavy Rain: from the northern Middle East to India (March – April)
(11) Warm: the Arabian Peninsula (January, May – June, September – October)
(12) Warm: in and around southern Europe (June – December)
(13) Dry: from eastern to central Europe (February, April, June – August)
(14) Heat Wave: from northern to central Europe (June – July)
(15) Wet: in and around Spain (April, August – September, November)
(16) Warm: from the western part of Western Africa to the western part of Middle Africa (July – September, November – December)
(17) Heavy Rain: from the northern to western part of Eastern Africa (October – December)
(18) Warm: from Mauritius to South Africa (January – December)
(19) Cyclone: the southern part of Eastern Africa (March – April)
(20) Warm: in and around Alaska (February – March, June – July, September)
(21) Dry: southwestern Canada (March, May, November)
(22) Wet: from the Midwestern to southeastern USA (February, April – May, September – October)
(23) Hurricane: from the eastern USA to the Bahamas (September)
(24) Warm: from the eastern USA to the northwestern part of South America (February, May – December)
(25) Warm: in and around Brazil (January – February, May – June, August – December)
(26) Wet: in and around northeastern Argentina (January, March, June)
(27) Warm: Australia (January, March, July, September – December)

(Kamiguchi Kenji, Tokyo Climate Center)

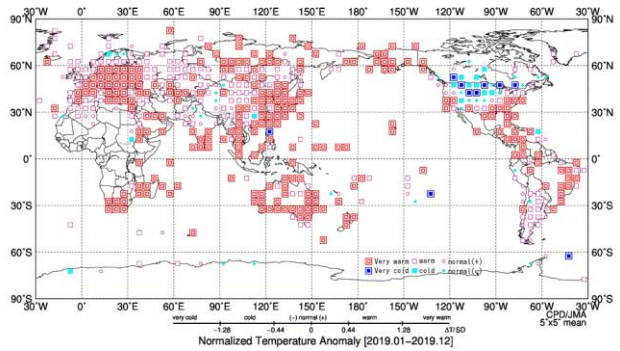

Figure 2-1 Normalized annual mean temperature anomalies for 2019

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 1981 – 2010 statistics. Land areas without graphics represent regions for which the observation data sample is insufficient or normal data are unavailable.

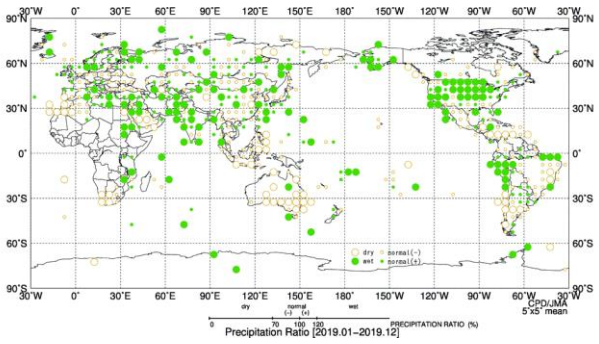

Figure 2-2 Annual total precipitation ratios for 2019

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.

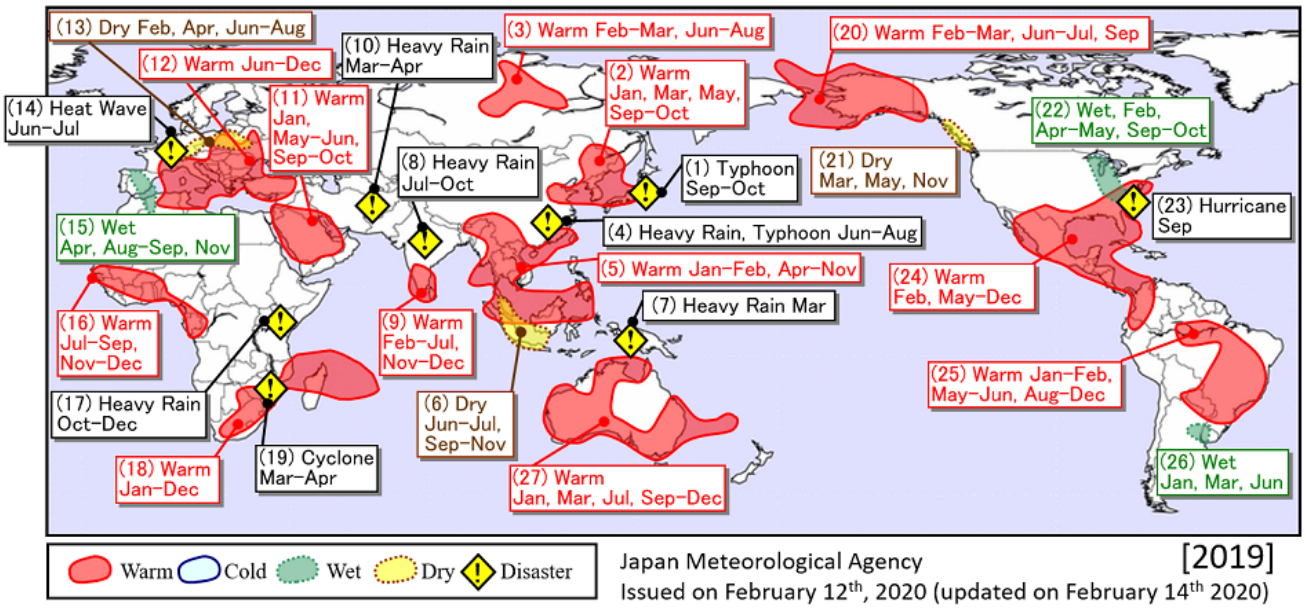

Figure 2-3 Major extreme climate events and weather–related disasters across the world in 2019

Schematic representation of major extreme climate events and weather–related disasters occurring during the year.

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Summary of Japan's Climatic Characteristics for 2019

Annual characteristics

Japan's climatic characteristics for 2019 can be summarized as follows:

- High temperatures persisted nationwide, with annual means significantly above normal in all regions. The mean for the eastern part of the country was the joint-highest (along with 2018) since 1946, at 1.1°C above normal.
- In early September, Typhoon Faxai (T1915) made landfall on eastern Japan, bringing record-strength winds around the Kanto region and gusts of up to 57.5 m/s in Chiba Prefecture. In mid-October, Typhoon Hagibis (T1919) also made landfall on eastern Japan before moving north, bring record precipitation in the area from eastern Japan to the Tohoku region. On 12 October, a national-record daily precipitation amount of 922.5 mm was recorded in Kanagawa Prefecture. Consequent river flooding caused extreme damage over large areas.
- In addition to the effects of these typhoons, record precipitation was repeatedly observed due to an active rain front and low-pressure systems over the country from summer to autumn. Daily precipitation of 400 mm or more was observed 47 times (the second highest since 1976) at AMeDAS stations nationwide during the year.

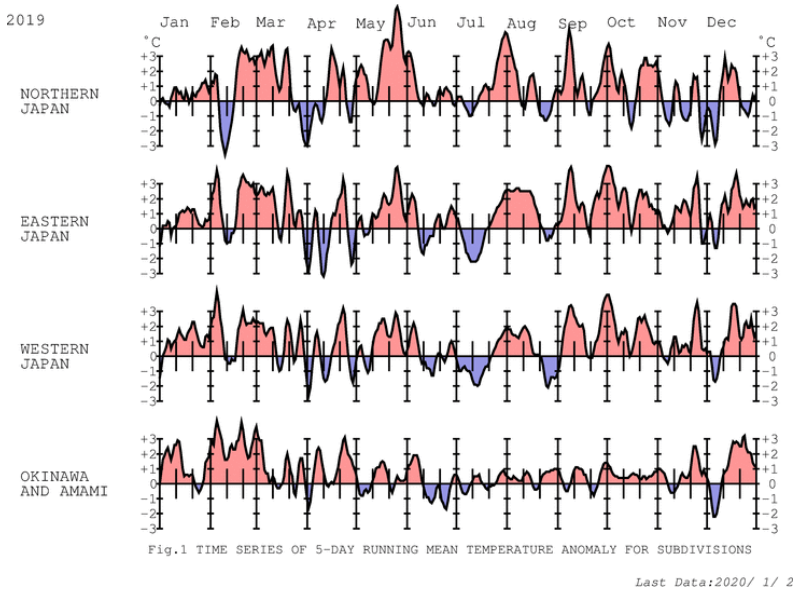

Figure 3-1 Time-series representation of five-day running mean temperature anomalies for subdivisions (January – December 2019)
The normal is the 1981 – 2010 average.

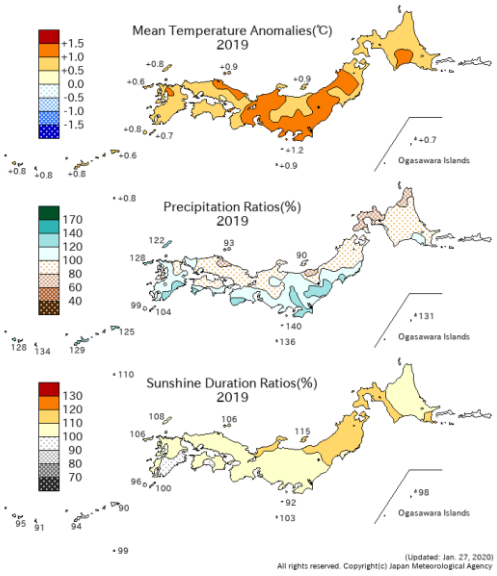

Figure 3-2 Annual climate anomalies/ratios for Japan in 2019

Seasonal characteristics

(a) Winter (December 2018 – February 2019)

Mild winter conditions were observed over most of the country due to a weaker-than-normal winter monsoon. Seasonal mean temperatures from eastern Japan to Okinawa/Amami were significantly above normal, and seasonal snowfall amounts on the Sea of Japan side were significantly below normal.

(b) Spring (March – May)

Sunny conditions persisted from northern to western Japan in spring due to frequent high-pressure system coverage. Seasonal sunshine durations in northern Japan and on the Sea of Japan side of eastern/western Japan were the highest since 1946. Warm air flowing over the country also brought relatively warm spring conditions nationwide.

(c) Summer (June – August)

The Baiu front remained over mainland Japan in July, and rainy/cloudy weather persisted in eastern/western Japan during the month. The Pacific High covered the country after the withdrawal of the Baiu front, and hot sunny conditions prevailed in eastern Japan and elsewhere.

Active rain fronts and typhoons repeatedly brought record-heavy rainfall to the Kyushu region in July and August, resulting in river flooding and landslides.

(d) Autumn (September – November)

Seasonal mean temperatures in eastern/western Japan were the highest since 1946 in association with high-pressure systems and warm air from the south.

Typhoons Faxai and Hagibis caused extensive damage over areas from eastern to northern Japan. Okinawa/Amami was also affected by several typhoons, with heavy precipitation and strong winds often observed in the region.

(Ohno Hiroshi, Tokyo Climate Center)

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TCC contributions to ASEANCOF-13 and visit to MSS

The Thai Meteorological Department hosted the Thirteenth ASEAN Climate Outlook Forum (ASEANCOF-13) from 20 to 21 November 2019 in Bangkok, Thailand, in collaboration with Meteorological Service Singapore (MSS) as the host of the ASEAN Specialised Meteorological Centre. Attendees discussed the climatic conditions of the upcoming winter monsoon season, which generally lasts from December to January.

As part of the activities of WMO's World Meteorological Centre (WMC), two TCC representatives provided a winter monsoon season 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 areas. This information was provided to support the output of country-scale outlooks by National Meteorological and Hydrological Services (NMHSs) in the ASEAN region and to contribute to the summarization of a consensus outlook for Southeast Asia. One of the representatives also chaired a session on enhanced use of climate services based on ASEANCOF activities.

On 25th November 2019, the TCC representatives paid a visit to MSS to enhance collaboration with JMA, providing two seminars on model development and the activities of WMC Tokyo and TCC. Potential collaborative activities relating to extended and long-range forecasting were also discussed, with focus on the prediction of associated drivers such as the El Niño-Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD) and the Madden Julian Oscillation (MJO).

(Shimpo Akihiko and Komori Takuya, Tokyo Climate Center)

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TCC Training Seminar on Climate Analysis Information on Extreme Climate Events

Tokyo Climate Center (TCC) has engaged in efforts to help National Meteorological and Hydrological Services (NMHSs) improve their climate services since 2008. One of the Center's major activities in this regard is to provide capacity development courses at its agency and at other NMHSs in the Asia-Pacific region, with the aims of enhancing professional capacity to process TCC climate information and promoting discussions on support for climate services. TCC holds annual training seminars in Tokyo as part of capacity development activities in its role as a Regional Climate Centre (RCC) in the WMO Regional Association II area.

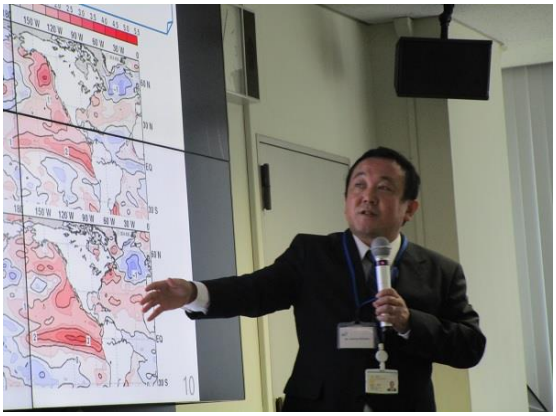
The Center held an annual training seminar from 25 to 29 November 2019 at JMA Headquarters in Tokyo, targeting the provision of analysis-based information on extreme climate events. The event was attended by 15 experts from NMHSs in Bangladesh, Bhutan, Hong Kong (China), Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, the Philippines, Sri Lanka, Thailand and Viet Nam. The event focused on conditions that produce extreme climate events and on the production of climate analysis information, with presentations from JMA experts and practical exercises using real data, related products and a web-based resource. The course content is provided on the TCC website to support attendees with related application in their home countries. At the end of the seminar, all participants gave presentations on past extreme climate events in their own countries and engaged in fruitful discussions with lecturers and others present.

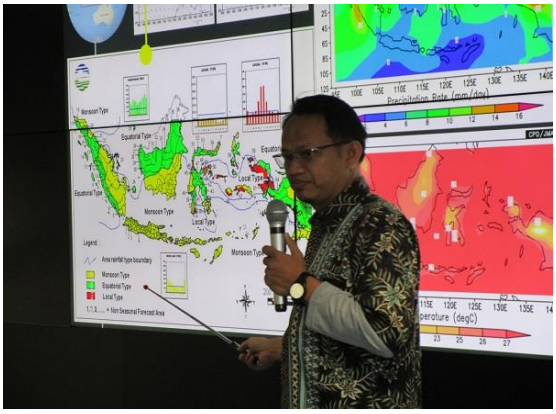
The content of the lectures is available on the TCC website at https://ds.data.jma.go.jp/tcc/tcc/library/library2019.html.

Attendees on a courtesy visit to JMA Director-General Mr. Sekita Yasuo
(25 November 2019, Director-General's office)

Attendees with JMA Global Environment and Marine Department Director-General Mr. Obayashi Masanori and other JMA staff





Lectures and practical exercises at the seminar

(Tsuji Kazuaki, Tokyo Climate Center)

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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 regional climate services, TCC operates a dedicated website at https://ds.data.jma.go.jp/tcc/RaiiInfoshare/ (see TCC News No. 36 and No. 50 for more information).

A July 2019 questionnaire survey conducted by TCC to support updating of the website generated responses from as much as 13 countries. Based on the information provided, the site was refined in December. TCC is committed to supporting the improvement of RA II climate services via the operation of the website.

(Tsuji Kazuaki, Tokyo Climate Center)

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TCC Activity Report for 2019

In 2019, the Tokyo Climate Center (TCC) continued to support the climate services of National Meteorological and Hydrological Services (NMHSs) in Asia-Pacific countries by providing and enhancing data and products, holding training seminars, dispatching experts and hosting visitors.

1. Enhancement and provision of data/products/tools on the TCC website

1.1 Launch of the new JMA's One-month Guidance Tool

TCC has launched a new interactive tool enabling the generation of statistical guidance for station points in support of operational seasonal forecasts covering periods of a month or less. This handy resource is in the form of a web-based application accessed via a browser on the TCC website at: https://ds.data.jma.go.jp/tcc/tcc/products/model/index.html (see the bottom of the "One-month Prediction" section)

For more details and system specifications, see the online help page at https://extreme.kishou.go.jp/tool/simple_guidance/help/ (tool commentary). As the tool provides forecasts and related materials, access is exclusive to National Meteorological and Hydrological Service (NMHS) staff. To gain access, see application webpage at https://ds.data.jma.go.jp/tcc/tcc/products/model/Application.html.

1.2 Incorporation of Standardized Precipitation Index (SPI) for drought monitoring into the ClimatView tool

TCC began providing worldwide drought monitoring information via its interactive online ClimatView tool in March 2019 to assist National Meteorological and Hydrological Services (NMHSs) in their monitoring of current and historical drought statuses. For this resource, TCC uses Standardized Precipitation Index (SPI) data as a measure of the degree of prolonged rainfall deficit. The tool displays SPI values for periods of 3, 6 and 12 months to help users quantify precipitation deficits on multiple timescales. This detailed drought information can be accessed on the TCC website at https://ds.data.jma.go.jp/tcc/tcc/products/climate/climatview/frame.php (main page). Commentary on SPI and its calculation method is available at https://ds.data.jma.go.jp/tcc/tcc/products/climate/climatview/spi_commentary.html. The tool shows SPI values covering the period from June 1982 to the present in the various format, e.g. graphical distribution map, time-series graphs with corresponding data tables and downloadable CSV files, regional listings and printable figures.

1.3 Issuance of summaries of the Asian summer/winter monsoon

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

1.4 Update of website on RA II Information sharing for Climate Services

For the improvement of climate services and successful implementation of the Global Framework for Climate Services, 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 RA II. In response to related decisions taken at the 15th and 16th sessions of Regional Association II (RA II) to improve information sharing on climate services in the region, TCC operates a dedicated website (https://ds.data.jma.go.jp/tcc/RaiiInfoshare/, see TCC News No.36 and No.50 for more information).

A July 2019 questionnaire survey conducted by TCC for updating of the website generated responses from more than 10 Members thanks to the kind cooperation of their involvement. Based on the information provided, the site was updated and refined in December 2019.

2. Capacity development

TCC holds annual training seminars as part of capacity-development activities related to its role as an RCC in RA II. In addition to running annual training seminars, it also arranges expert visits to and hosts visitors from NMHSs to support exchanges of views on climate services and the effective transfer of technology.

2.1 Training seminar

TCC holds a training seminar in each of its fiscal years (from April to March), and also held a seminar on climate analysis information on extreme climate events in November 2019. Details of the events are reported in TCC News No. 59.

2.2 Expert visits and other follow-up activities

TCC experts visited the National Agency for Meteorology and Environmental Monitoring of Mongolia (NAMEM) in July, to hold a "TCC follow-up training seminar on one-month forecasts and on the basic operation of TCC's Interactive Tool for Analysis of the Climate System (iTacs)". Discussions on future cooperation with NAMEM were also held (TCC News No. 57).

From 30 to 31 July 2019, five BMKG climate experts underwent training at JMA's Headquarters to reinforce capacity in the development of fit-for-purpose climate information based on essential expertise in climate analysis and related application.

In November 2019, two TCC experts visited the Centre for Climate Research Singapore (CCRS) of the Meteorological Service Singapore to explore areas of scientific collaboration.

Other follow-up to previous TCC training seminars included hosting visiting experts at TCC and conducting teleconferences to provide technical support.

3. International meetings

3.1 Regional Climate Outlook Forums

TCC attendees gave presentations on seasonal predictions based on JMA's numerical model and participated in discussions toward the formulation of a consensus statement on regional forecasts.

- RCCs are expected to actively contribute to and lead profound discussions in Regional Climate Outlook Forums (RCOFs). In 2019, TCC experts participated in the following RCOFs in Asia:
- Fifteenth session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Regional

Association II (FOCRA II-15) held in Nanning, China, from 8 to 10 May

- Fourteenth session of the South Asian Climate Outlook Forum (SASCOF-14) held in Kathmandu, Nepal, from 18 to 23 April
- Fifteenth session of the South Asian Climate Outlook Forum (SASCOF-15) held in Thiruvananthapuram, India, from 23 to 25 September
- Seventh session of the East Asia winter Climate Outlook Forum (EASCOF-7) held in Ulaanbaatar, Mongolia, from 5 to 7 November
- Thirteenth session of the ASEAN Climate Outlook Forum (ASEANCOF-13) held in Bangkok, Thailand, from 20 to 21 November

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 2019, TCC News No. 55 – 58 were issued and made available on the TCC website.

The Japan Meteorological Agency's annual Climate Change Monitoring Report for 2018 is also available on the JMA/TCC website.

5. Plans for 2020

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

RCCs are expected to play a major role in the implementation of the GFCS. TCC plans to further strengthen its activities and lead RA II's contribution to the Framework. Such activities include the provision of further assistance to NMHSs for better climate services, as well as maintenance of the portal site for Information Sharing on Climate Services in RA II.

5.2 New/upgraded data, products and tool development

TCC plans to implement a major upgrade of its Global Ensemble Prediction System for operational one-month forecasting in spring 2020.

Another effort includes investigation of teleconnection indices (e.g., the Arctic Oscillation Index) to enhance monitoring of atmospheric circulation with the use of the JRA-55 long-term reanalysis dataset. TCC plans to publish the investigation results and the indices on its website as soon as material is ready.

5.3 Capacity development

In the first quarter of 2021 (the last quarter of the fiscal year 2020), TCC will hold its annual training seminar with a dozen invited experts as attendees. The Center will also continue to dispatch experts to NMHSs as necessary and host visitors from NMHSs upon request.

5.4 Hosting of EASCOF

In autumn, TCC will host the eighth session of the East Asia Winter Climate Outlook Forum (EASCOF) with the participation of experts engaged in climate services at NMHSs and researchers from China, Japan, Mongolia and the

Republic of Korea. At the event, the climate conditions of the previous season will be reviewed, and the current status of the climate system as well as the seasonal Asian winter monsoon forecast for winter 2020/2021 will be discussed

(Mochizuki Yasushi, Tokyo Climate Center)

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You can also find the latest newsletter from Japan International Cooperation Agency (JICA).
JICA's World (January 2020)
https://www.jica.go.jp/english/publications/j-world/2001.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 "The Mekong Region".

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: Takatsuki Yasushi, Mochizuki Yasushi and Tsuji Kazuaki)

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TCC Website:
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