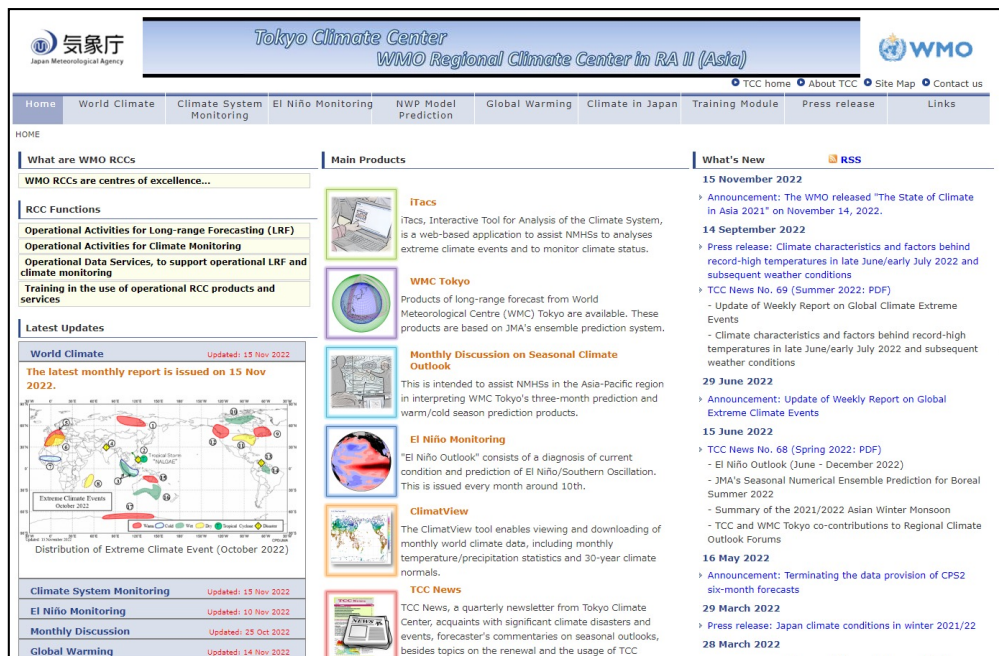


Introduction of Recent Updates of JMA/Tokyo Climate Center (TCC)'s Services



Tetsu NAKAMURA

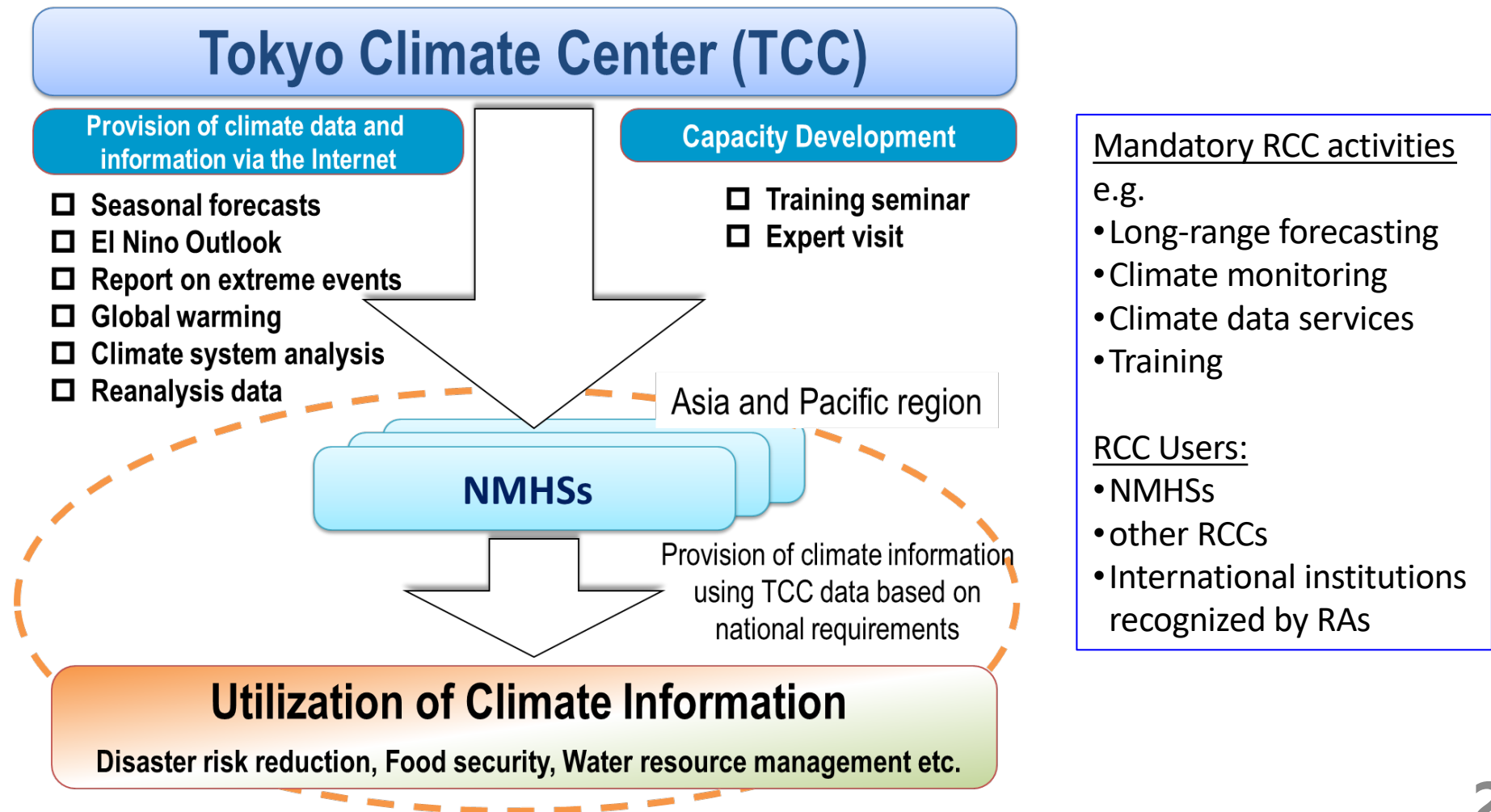
Tokyo Climate Center (TCC)
Japan Meteorological Agency (JMA)
tcc@met.kishou.go.jp

TCC Home page

<https://www.data.jma.go.jp/tcc/tcc/index.html>

TCC as Regional Climate Center (RCC)

- TCC has served as a WMO Regional Climate Center in RA II since 2009.
- TCC supports NMHSs through data/tool/information provision and capacity development activities.



Today's topic

Recent major updates of TCC's services

- Upgraded seasonal forecast model, **CPS3**.
- New Japanese reanalysis dataset, **JRA-3Q**.
- **Seasonal Tropical Cyclone forecast** will be launched in May on a trial basis.

TCC's activities on Capacity Development

- Annual Training Seminar
- Experts Visiting

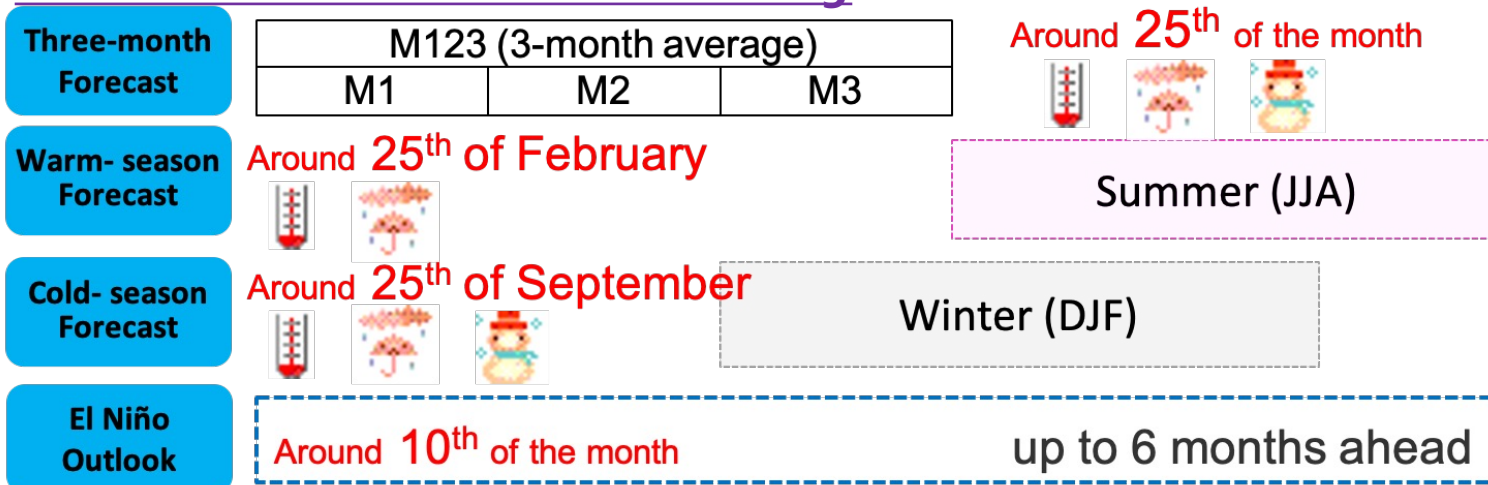
Operational global NWP models at JMA

- TCC provides numerical sub-seasonal to seasonal prediction products based on the ensemble prediction models (EPSs) in close collaborations with World Meteorological Center of Tokyo (WMC Tokyo) on its website.
- The **Seasonal EPS** used for seasonal prediction was upgraded in Feb 2022.

	Main Target	Horiz. Resol.	Ens. Size
Global Spectral Model (GSM)	•Short-range forecast	13km	
Global EPS (GEPS)	•Typhoon forecast •One-week forecast •Early Warning Info. on Extreme Weather •One-month forecast	27/40km (B/A 18 days)	50
Seasonal EPS (JMA/MRI-CPS3; Hirahara et al. 2023)	•Three-month forecast •Warm & Cold Season forecast •El Niño outlook (•Seasonal TC forecast)	(AGCM) 55km (OGCM) 25km	51

<https://www.data.jma.go.jp/tcc/tcc/products/model/outline/index.html>

Schedules of seasonal forecast & issuing



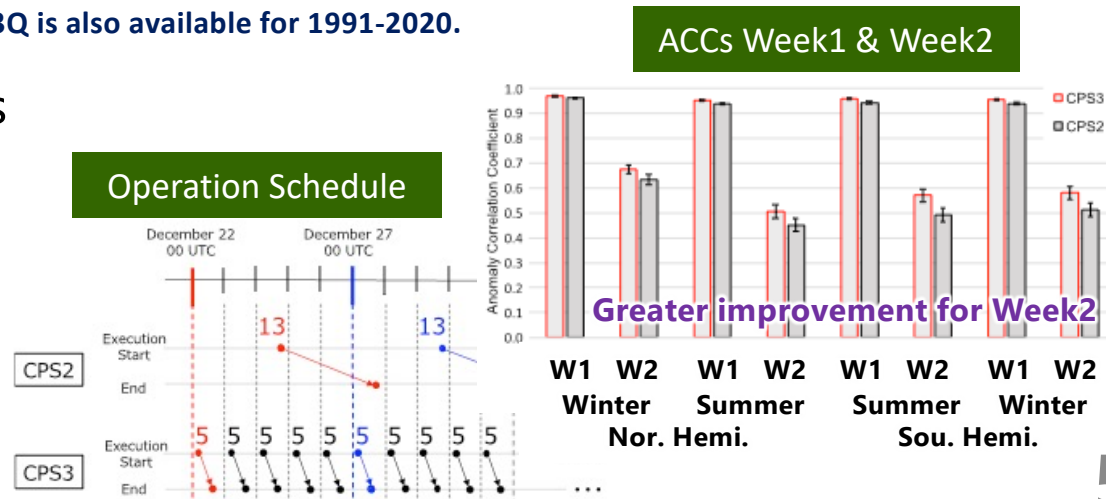
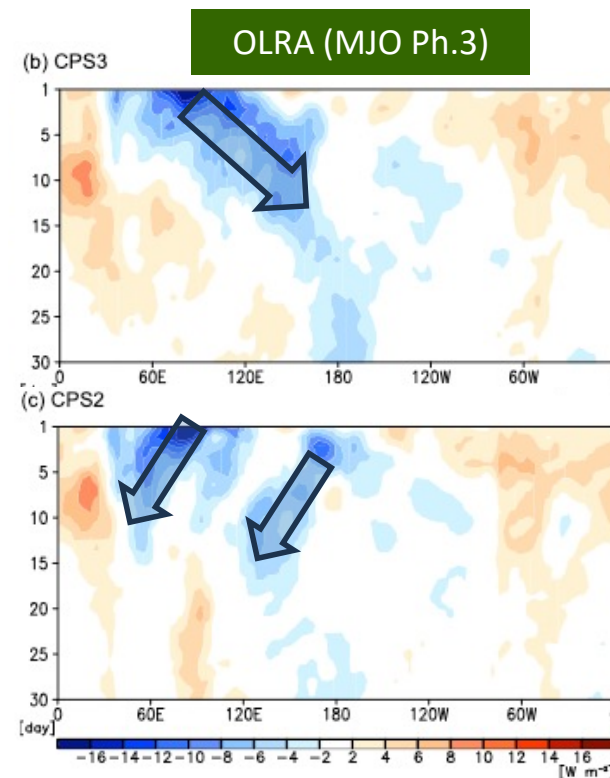
Upgraded Seasonal EPS (CPS3)

Table. Breif description of the model spec (Hirahara et al., 2023, JMSJ).

Model	JMA/MRI-CPS3 (since February 2022)
Horizontal Resolution	Atmosphere: TL319 (approx. 55km) Ocean: 0.25 ° (lon) × 0.25 ° (lat)
Vertical Layers	Atmosphere: 100 levels (up to 0.01hPa) Ocean: 60 levels
Initial Condition for Forecast	Atmosphere: Global Analysis Land: Offline Land Analysis (*) Ocean: 4DVAR(coarse res) + downscaling(eddy permitting res), daily (*) Sea Ice: 3DVAR, daily (*) * Same forcing as atmosphere
Forecast Range	7 months
Number of Ensemble	5 members per day (51 members with LAF)
Frequency of Forecast	Every day

Hindcast initialized by JRA-3Q is also available for 1991-2020.

- CPS3 shows greater improvements of representation of subseasonal to seasonal scale variability (esp., **MJO**, **Blocking-H.**, **ENSO**).
- The usability has been also improved by reorganizing the operation schedule.

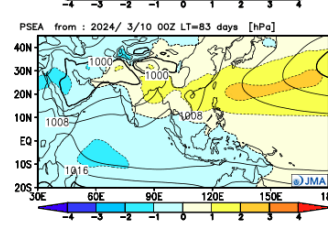
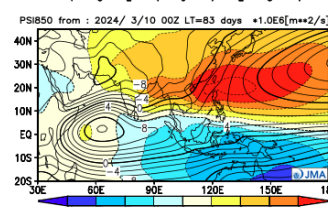
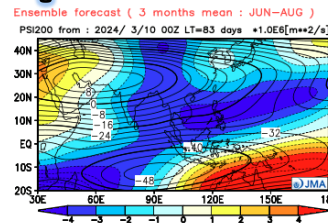
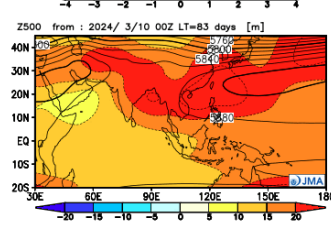
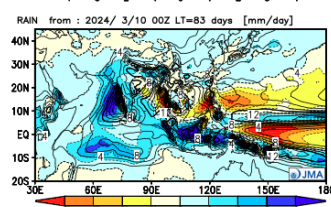
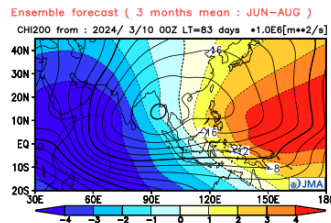
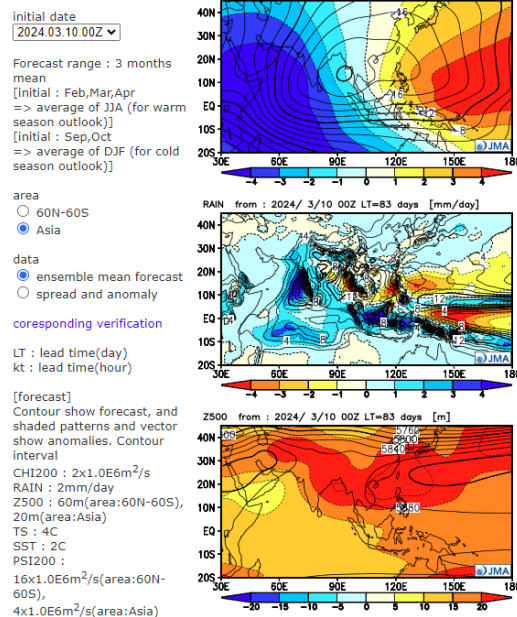


Forecast and verification maps

- JMA provides ensemble forecasts and the related verification maps. The verification results using the re-forecast (hindcast) dataset are also available to conduct **the predictability assessments**.

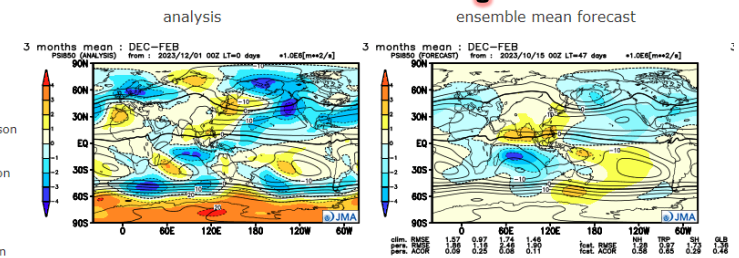
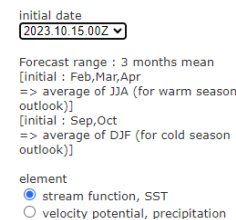
Forecast Maps

Forecast Maps

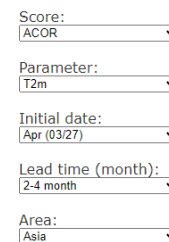


Verification Maps

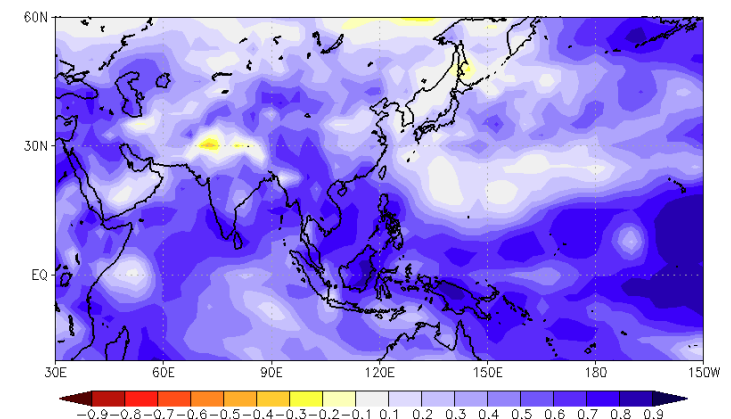
Verification Maps



Re-forecast Verification



<CPS3(10mem) : JRA-3Q>
TS anomaly (with bias-correction)
Anomaly Correlation for 30 years (1991-2020)
Initial : 0327, 3mon mean : mon 02-04



Update Date of forecast maps

- One-month Forecast: Every Thursday
- Three-month Forecast: Every month
- Warm season Forecast: Feb., Mar. and Apr.
- Cold season Forecast: Sep. and Oct.

<https://www.data.jma.go.jp/tcc/tcc/products/model/index.html>

JRA-3Q: Reanalysis for Three Quarters of a Century

- JMA is currently conducting the Japanese Reanalysis for Three-Quarters of a Century (JRA-3Q; Kosaka et al. 2024), which covers the period from September 1947 onward.
- JRA-3Q data are provided to users from several sites such as DIAS (<https://search.diasjp.net/en/dataset/JRA3Q>) and NCAR.

History of JMA Reanalysis data

JRA-25 (Co-project with CRIEPI)
(1979-2004)

JRA-55 (JRA Go! Go!) (1958-2022)

JRA-3Q (Three quarters)(1947-)



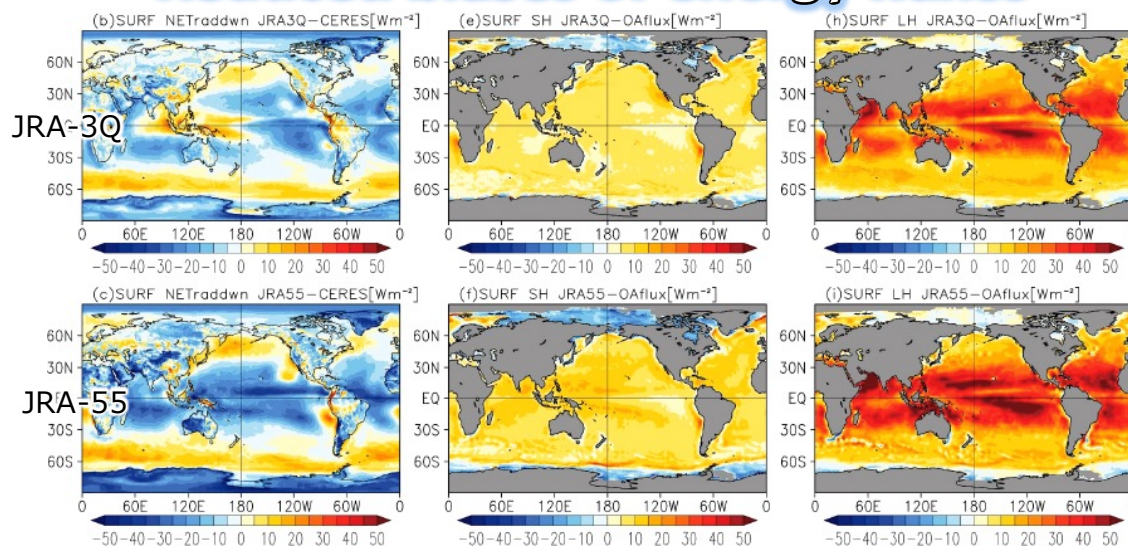
	JRA-55	JRA-3Q
Period	1958~	1947~
System	JMA's as of Dec2009	JMA's as of Dec. 2018
H. resol.	T _L 319 (~55 km)	T _L 479 (~40 km)
Levels	60 levels up to 0.1 hPa	100 levels up to 0.01 hPa
Scheme	4D-Var (T106 inner)	4D-Var (T _L 319 inner res.)
Rad. temp. bias corr.	~2006: RAOBCORE V1.4 2007~: RAOBCORE V1.5	RISE (RICH with solar elevation dependent) v1.7.2
Sat. Rad	RTTOV-9.3	RTTOV-10.2
Land surf,	Offline SiB	Cycle of land surf. forecast
SST and sea ice	COBE-SST: 1deg	MGDSST (0.25-degree): 1985~ COBE-SST2 (1deg): ~1990
Ozone	MRI-CCM1(T42L68)1979~ Climatology: ~1978	MRI-CCM2(T _L 159L64) offline

https://jra.kishou.go.jp/JRA-3Q/index_en.html

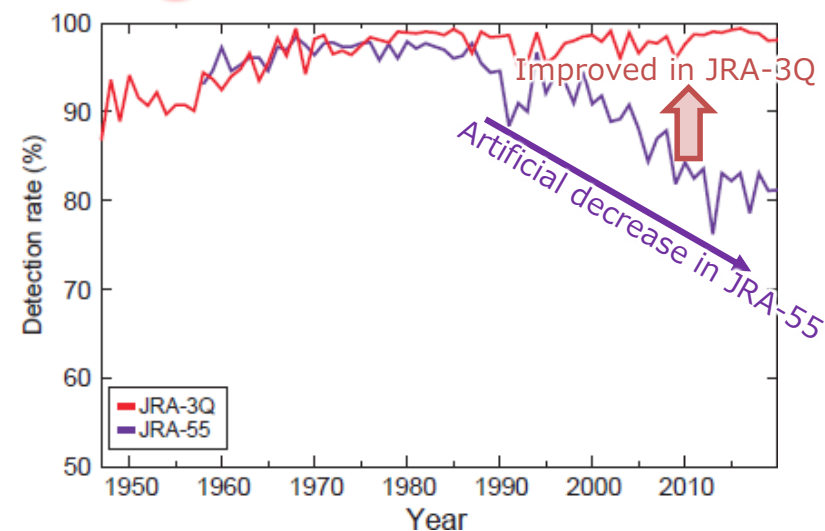
Improvement of JRA-3Q from JRA-55

- Many of the deficiencies in the previous reanalysis (JRA-55; Kobayashi et al. 2015) are alleviated in JRA-3Q. Then, JRA-3Q provides a more high-quality homogeneous dataset (Kosaka et al. 2024). For example, ...
 - The large upward imbalance in the global mean net energy flux at the top of the atmosphere and at the surface has been significantly reduced as a result of overall improvements in parameterizations of physical processes.
 - The artificial decrease in the detection of tropical cyclones (TCs) has been resolved by the use of a TC bogus generation method.

Reduced biases of energy fluxes



Higher TC detection rate

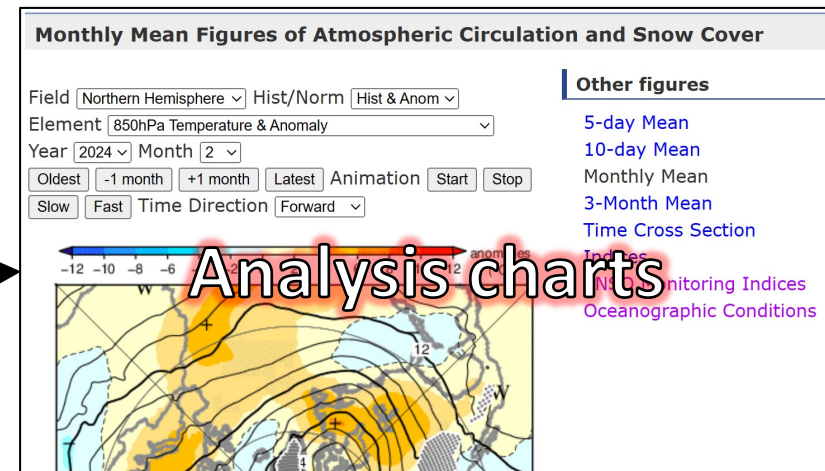


Climate System Monitoring using JRA-3Q

- JMA monitors the climate system focusing on atmospheric circulation, tropical convection, oceanographic conditions, and snow cover to understand/explain background factors of the present climate conditions.
- In May 2023, the products were refined to those based on **JRA-3Q** and the related oceanographic dataset (COBE-SST2 (Hirahara et al. 2014), MGDSSST (Kurihara et al. 2006), and MOVE/MRI.COM-G3). The products based on the outgoing longwave radiation (OLR) were also updated to those based on the new dataset (NOAA/CPC Blended OLR).

The screenshot shows the top navigation bar of the JMA Climate System Monitoring website. The 'Climate System Monitoring' link is highlighted with a red box. Below the navigation bar, the 'HOME > Climate System Monitoring' breadcrumb is visible. The main heading 'Climate System Monitoring' is followed by three dots. Under the 'Main Products' section, there are three links: 'Report on Climate System', 'Reports on Specific Events (01 Mar 2024)', 'Monthly Highlights on the Climate System (February 2024)', and 'Seasonal Highlights on the Climate System (Winter, December 2023 - February 2024)'. Below this, the 'Monitoring and Statistical Analysis (Explanation)' section lists several analysis charts and monitoring indices, including 'Analysis Charts and Monitoring Indices', 'Asian monsoon monitoring (28 Mar 2024)', 'Madden-Julian Oscillation (MJO) (28 Mar 2024)', 'Stratospheric circulation (28 Mar 2024)', and 'Composite map for El Niño / La Niña and Indian Ocean Dipole events'.

This screenshot shows the 'Monthly Highlights on the Climate System' page. The title is 'Monthly Highlights on the Climate System'. Below it, a note states: 'Monthly Highlights on the Climate System has been issued in PDF format since March 2007 as a monthly bulletin for the public. The latest issue is available on the website.' The section 'Highlights in February 2024' lists three bullet points: '- Oceanic indicators show that ongoing El Niño conditions in the equatorial Pacific have already peaked and are expected to continue until around 11 March 2024.', '- Monthly mean temperatures were significantly above normal in eastern/western Japan and Okinawa/Amami, and were above normal in northern Japan.', and '- Convective activity was enhanced over the tropical central Pacific and the western to central parts of the Indian Ocean, and suppressed from the eastern Indian Ocean to Indonesia, and from'.



<https://www.data.jma.go.jp/tcc/tcc/products/clisys/>

Seasonal Tropical Cyclone Forecast

- Seasonal TC forecast is planned to be launched in **May 2024 on a trial basis**.
- The products are based on CPS3 seasonal forecast.
- Users are assumed to be experts from NMHSs (registration required).

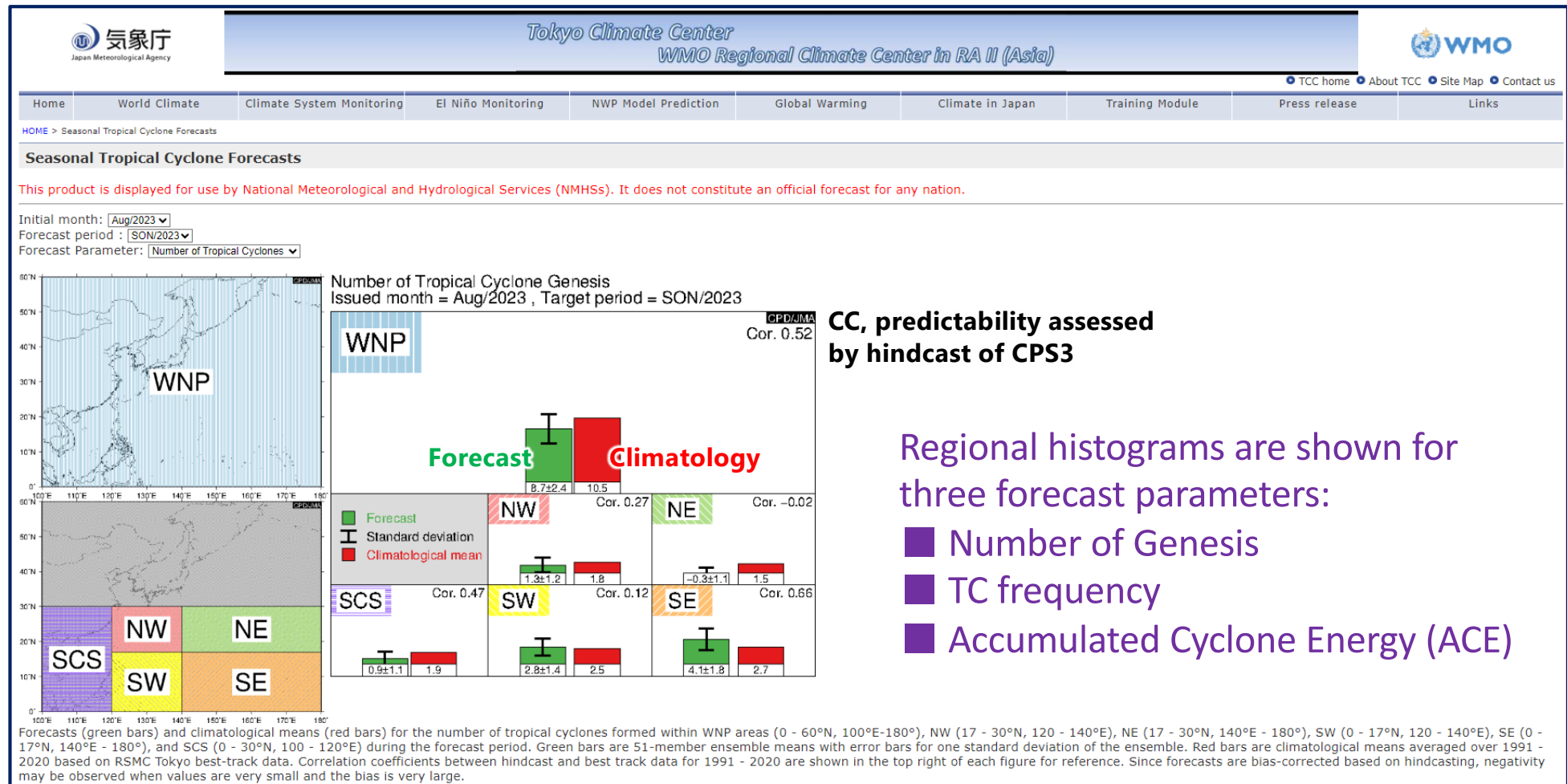
The screenshot displays the Tokyo Climate Center (TCC) website, which is part of the WMO Regional Climate Center in RA II (Asia). The page features a navigation bar with links to Home, World Climate, Climate System Monitoring, El Niño Monitoring, NWP Model Prediction, Global Warming, Climate in Japan, Training Module, Press release, and Links. The main content area is divided into several sections:

- What are WMO RCCs:** WMO RCCs are centres of excellence...
- RCC Functions:** Operational Activities for Long-range Forecasting (LRF), Operational Activities for Climate Monitoring, Operational Data Services, to support operational LRF and climate monitoring, Training in the use of operational RCC products and services.
- Latest Updates:** A table listing updates for World Climate, Climate System Monitoring, El Niño Monitoring, Monthly Discussion, Global Warming, and Climate in Japan.
- Main Products:**
 - ITacs:** Interactive Tool for Analysis of the Climate System, is a web-based application to assist NMHSs to analyse extreme climate events and to monitor climate status.
 - WMC Tokyo:** Products of long-range forecast from World Meteorological Centre (WMC) Tokyo are available. These products are based on JMA's ensemble prediction system.
 - Monthly Discussion on Seasonal Climate Outlook:** This is intended to assist NMHSs in the Asia-Pacific region in interpreting WMC Tokyo's three-month prediction and warm/cold season prediction products.
 - El Niño Monitoring:** "El Niño Outlook" consists of a diagnosis of current condition and prediction of El Niño/Southern Oscillation. This is issued every month around 10th.
 - ClimatView:** The ClimatView tool enables viewing and downloading of monthly world climate data, including monthly temperature/precipitation statistics and 30-year climate normals.
 - TCC News:** TCC News, a quarterly newsletter from Tokyo Climate Center, acquaints with significant climate disasters and events, forecaster's commentaries on seasonal outlooks, besides topics on the renewal and the usage of TCC products.
 - Seasonal Tropical Cyclone Forecasts (Experimental):** This product is intended to assist NMHSs in the Asia-Pacific region. Only registered NMHSs can access this product.
- What's New:**
 - 29 March 2024:** TCC News No. 75 (Winter 2024: PDF). Global temperature for 2023 was the highest since 1891. Highlights of the Global Climate in 2023. Summary of Japan's climatic characteristics for 2023. TCC Expert Visit to TMD. TCC Training Seminar on Seasonal Forecast. TCC Activity Report for 2023.
 - 22 December 2023:** Press release: Global temperature for 2023 to be the highest since 1891 (Preliminary).
 - 8 December 2023:** TCC News No. 74 (Autumn 2023: PDF). El Niño Outlook (November 2023 - May 2024). JMA's Seasonal Numerical Ensemble Prediction for Boreal Winter 2023/2024. Summary of the 2023 Asian Summer Monsoon. Status of the Antarctic Ozone Hole in 2023. Status of the Arctic Sea Ice in 2023. Eleventh session of the East Asia Winter Climate Outlook Forum. TCC and WMC Tokyo co-contributions to Regional Climate Outlook Forums.
 - 11 October 2023:** Announcement: Replacement of Outgoing Longwave Radiation (OLR) data used for El Niño Monitoring products.
- Related Links:**
 - Regional Climate Centers:** RA II Regional Climate Center (RCC) Network Homepage, Beijing Climate Center, National Climate Centre, Pune, North Eurasian Climate Center (NEACC), WMO RA VI RCC-Network.
 - Regional Climate Outlook Forum (RCOF):** Forum on Regional Climate Monitoring-Assessment-Prediction for Asia (FOCRAII), East Asia winter Climate Outlook Forum (EASCOF), South Asian Climate Outlook Forum (SASCOF), ASEAN Climate Outlook Forum (ASEANCOF), North Eurasian Climate Outlook Forum (NEACOF).

Here, coming soon.

Seasonal Tropical Cyclone Forecast

- A sample of **Forecast** page



Seasonal Tropical Cyclone Forecast

- A sample of **Verification** page

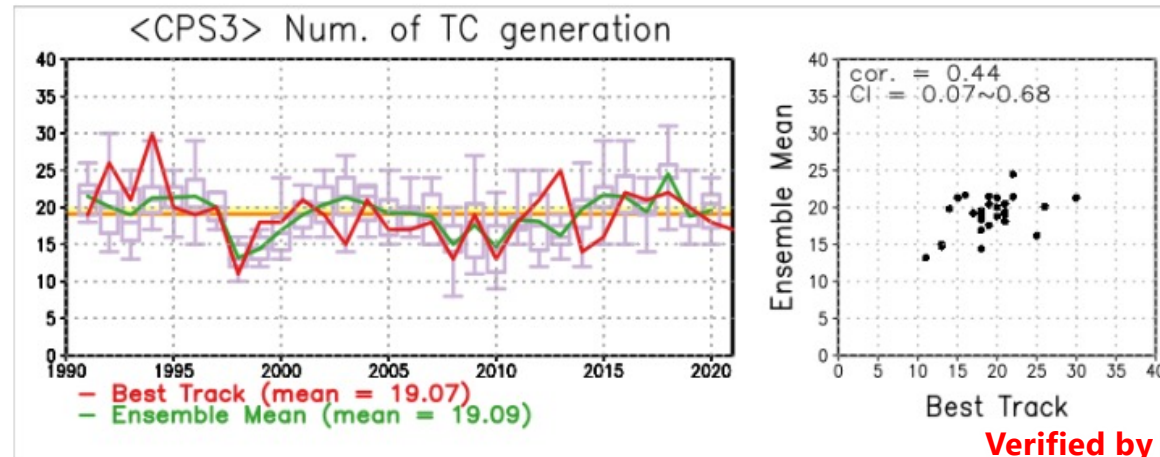
Hindcast Verification of Seasonal Tropical Cyclone Forecasts

Parameter:

Initial date:

Lead time (month):

Area:



Verified by Best-Track data

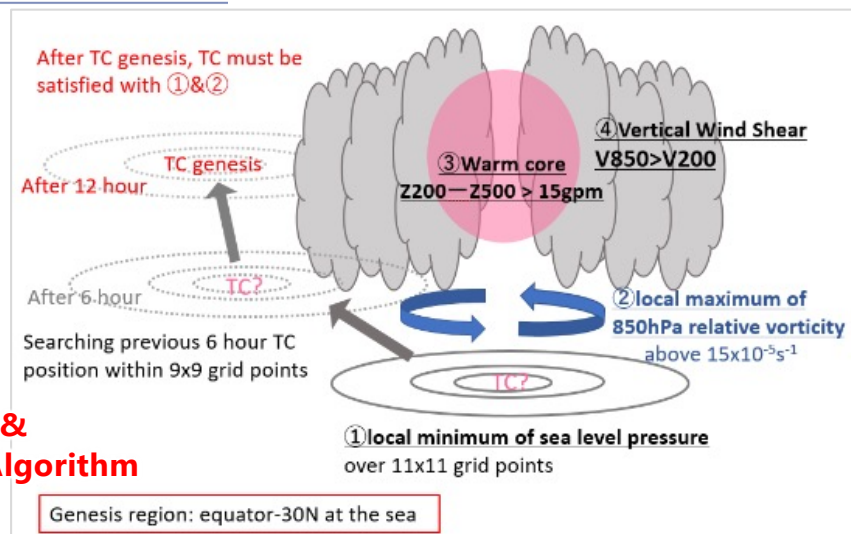
- A sample of **Explanation** page

Explanation of objective algorithm for detecting and tracking tropical cyclones

The product focuses on tropical cyclones of tropical storm (TS*) intensity and employs five criteria as discussed below. The intensity and structure of simulated typhoons forming in the WNP from this product to observation.

- Grid points over the ocean between the equator and 30°N with a local maximum of relative vorticity.
- Relative vorticity must be above a specified threshold. The threshold is $15 \times 10^{-5} \text{ s}^{-1}$.
- TCs must have a warm core structure defined by a 500 to 200-hPa thickness gradient of $200-2500 > 15 \text{ gpm}$.
- TCs must have a wind structure such that the wind speed at 850 hPa must be above 8 m/s .
- Conditions 1 and 2 above must continue for at least 12 hours for detection.

* A TS is defined as a tropical cyclone with a maximum sustained wind speed of 17.2 m/s or greater.



Detection & Tracking Algorithm

Capacity Development

TCC conducts annual training seminars as part of capacity-development activities related to its role as an RCC in RA II.

- (FY 2023) TCC Training Seminar On Seasonal Forecast
TCC held a seasonal forecasting training seminar in Jan/Feb 2024.
Attendees: 13 people from NMHSs in Asia
 - Exercises using JMA's Analysis and Guidance Tools
 - Hands-on working using own observation data
 - Presentations and Discussions for prediction of February – April in their countries
- (FY 2024) Planned, On Climate Monitoring and Diagnosis

Welcome to Tokyo/JMA!

TCC also arranges expert visits to and hosts visitors from NMHSs to support exchanges of views on climate services and the effective transfer of technology.

- (Feb 2023) Experts Visit to PAGASA (on one-month forecast)
- (June 2023) Experts Visit to MSS/CCRS (enhancement of collaboration)
- (Dec 2023) Experts Visit to TMD (on global warming)



(FY2023 Seminar)

Figure 5-2 Practical exercises



(FY2023 Seminar)

Figure 5-3 Presentation



(at TMD in Dec)

Figure 4-1 Practical exercises

Photos from TCC News Winter 2024

Thank you!

- Please visit TCC website and contact us when you have any questions.

Information on Tokyo Climate Center

Mailing Address : Tokyo Climate Center
Climate Prediction Division
Atmosphere and Ocean Department
Japan Meteorological Agency
3-6-9 Toranomom, Minato City, Tokyo 105-8431
Japan

Web Site : <https://ds.data.jma.go.jp/tcc/tcc/index.html>

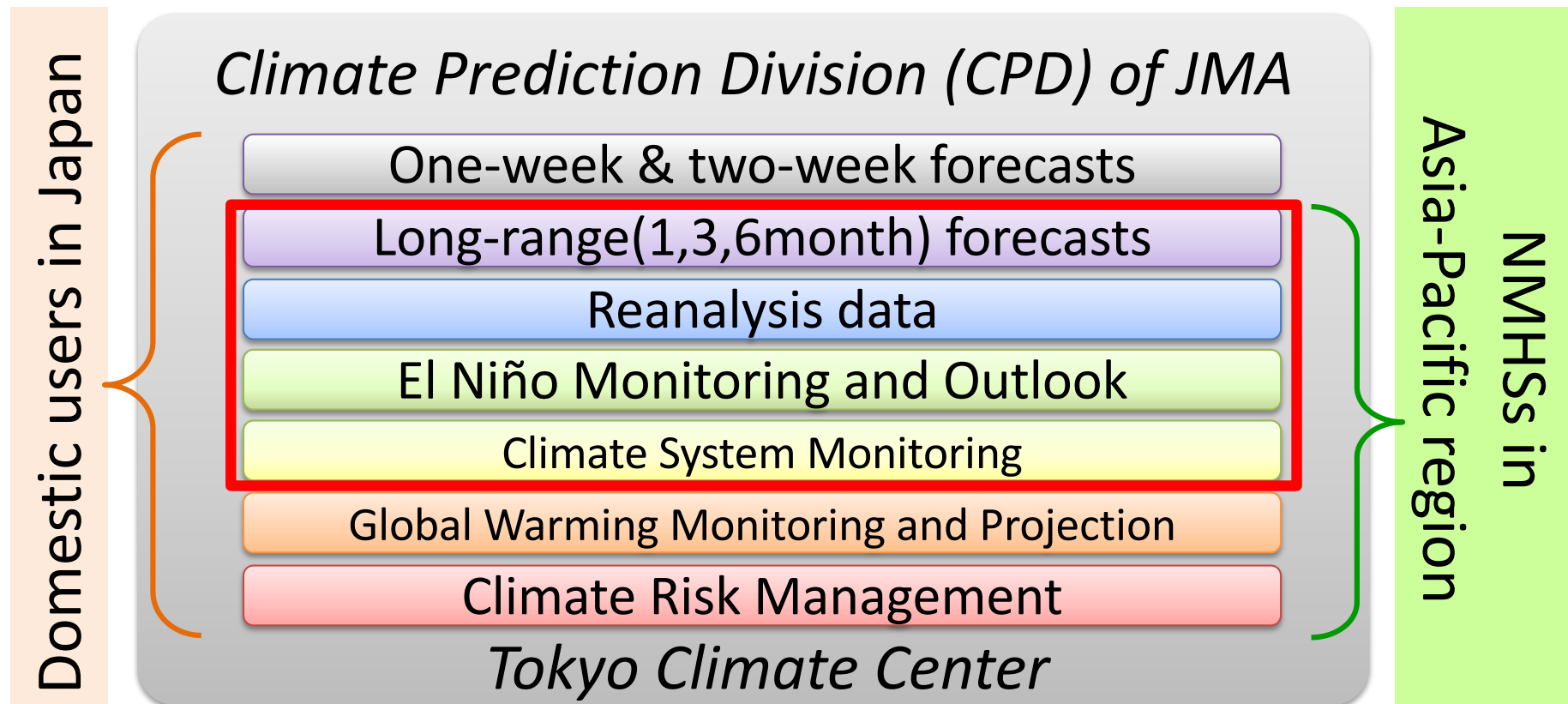
E-mail : tcc@met.kishou.go.jp



SUPPLEMENTAL MATERIAL

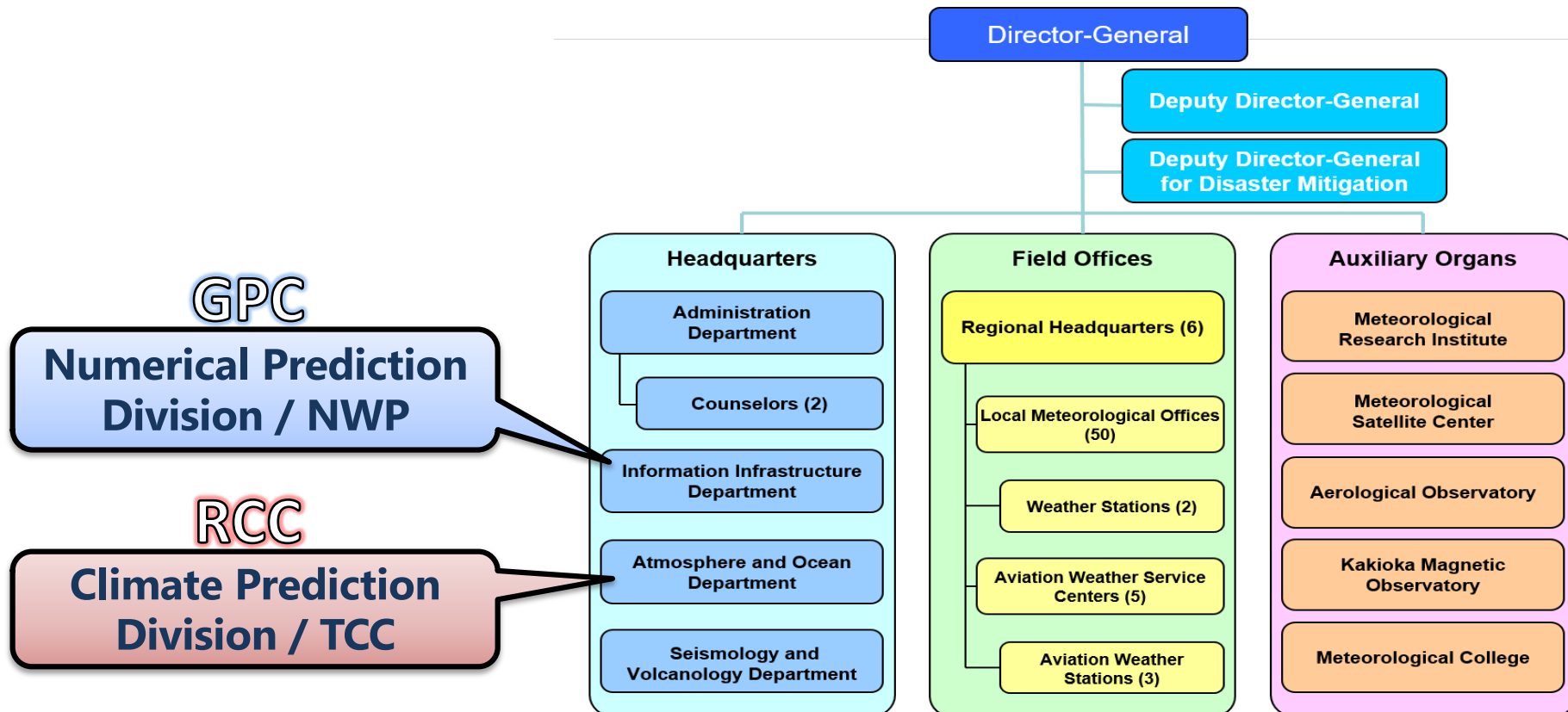
Provision of various climate information

- TCC provides various climate information for National Meteorological and Hydrological Services (NMHSs).
- This presentation briefly introduces the products of long-range forecast, reanalysis data, and climate system monitoring.



Structure of the Japan Meteorological Agency

- The headquarters of the Japan Meteorological Agency (JMA) were restructured in 2020.
- After the restructuration, **GPC Tokyo** and **RCC Tokyo** belong to the different divisions of the “**Information Infrastructure Department**” and “**Atmosphere and Ocean Department**”, respectively.



TCC website

- The following top page of the TCC website has many links to products in line with the RCC mandatory function.



Tokyo Climate Center
WMO Regional Climate Center in RA II (Asia)



[TCC home](#)
[About TCC](#)
[Site Map](#)
[Contact us](#)

Home	World Climate	Climate System Monitoring	El Niño Monitoring	NWP Model Prediction	Global Warming	Climate in Japan	Training Module	Press release	Links
------	---------------	---------------------------	--------------------	----------------------	----------------	------------------	-----------------	---------------	-------

HOME

What are WMO RCCs

WMO RCCs are centres of excellence...

RCC Functions

- Operational Activities for Long-range Forecasting (LRF)
- Operational Activities for Climate Monitoring
- Operational Data Services, to support operational LRF and climate monitoring
- Training in the use of operational RCC products and services

Latest Updates

World Climate

Updated: 29 Sep 2023

The latest monthly report is issued on 29 Sep 2023.



Extreme Climate Events August 2023

Distribution of Extreme Climate Event (August 2023)


Climate System Monitoring

Updated: 15 Sep 2023

El Niño Monitoring

Updated: 11 Sep 2023

Main Products




iTacs

iTacs, Interactive Tool for Analysis of the Climate System, is a web-based application to assist NMHSs to analyses extreme climate events and to monitor climate status.



WMC Tokyo

Products of long-range forecast from World Meteorological Centre (WMC) Tokyo are available. These products are based on JMA's ensemble prediction system.



Monthly Discussion on Seasonal Climate Outlook

This is intended to assist NMHSs in the Asia-Pacific region in interpreting WMC Tokyo's three-month prediction and warm/cold season prediction products.



El Niño Monitoring

"El Niño Outlook" consists of a diagnosis of current condition and prediction of El Niño/Southern Oscillation. This is issued every month around 10th.



ClimatView


The ClimatView tool enables viewing and downloading of monthly world climate data, including monthly temperature/precipitation statistics and 30-year climate normals.



TCC News

TCC News, a quarterly newsletter from Tokyo Climate

What's New



28 September 2023

- Press release: Climate characteristics and factors behind heavy rainfall during the Baiu season in 2023 and extremely high temperatures from mid-July onward
- TCC News No. 73 (Summer 2023: PDF)
 - TCC and GPC Tokyo representatives' visit to MSS
 - TCC contributions to the Report on the States of the Climate in Asia 2022
 - Climate characteristics and factors behind heavy rainfall during the Baiu season in 2023 and extremely high temperatures from mid-July onward
 - Record global mean surface temperature based on JRA-3Q reanalysis

1 August 2023

- Announcement: The WMO released "The State of Climate in Asia 2022" on July 27, 2023.

13 June 2023

- TCC News No. 72 (Spring 2023: PDF)
 - El Niño Outlook (May - November 2023)
 - JMA's Seasonal Numerical Ensemble Prediction for Boreal Summer 2023
 - Summary of the 2022/2023 Asian Winter Monsoon
 - Commencement of JRA-3Q utilization in diagnosis products and iTacs
 - TCC and WMC Tokyo co-contributions to Regional Climate Outlook Forums

30 May 2023

- Announcement: Products using new dataset (JRA-3Q and MGDST/COBE-SST2) are available

<https://www.data.jma.go.jp/tcc/tcc/index.html>

TCC's long-range forecast products

- JMA serves as a WMO Global Producing Centre for Long-range Forecasts (GPC-LRF-Tokyo).
- LRF products consist of 3-month and warm/cold season forecasts.
- Forecast and verification products of GPC-LRF-Tokyo are provided via the TCC website.

The screenshot displays the Tokyo Climate Center (TCC) website, which is the WMO Regional Climate Center in RA II (Asia). The header includes the Japan Meteorological Agency (JMA) logo and the WMO logo. A navigation bar contains links to TCC home, About TCC, Site Map, and Contact us. Below this is a menu with categories: Home, World Climate, Climate System Monitoring, El Niño Monitoring, **NWP Model Prediction** (highlighted with a red box), Global Warming, Climate in Japan, Training Module, Press release, and Links. The main content area is titled "JMA's Ensemble Prediction System (Products for Long-Range Forecasting of WMC Tokyo)". It describes the JMA's role as a WMO World Meteorological Centre (WMC) operating an ensemble prediction system for one-month and three-month forecasts. The page is divided into two sections: "Notice" and "Main Products". The "Notice" section lists two announcements: one from May 2022 regarding the termination of CPS2 six-month forecasts, and another from March 2022 regarding the upgrade of the Global EPS for one-month prediction. The "Main Products" section lists several products: One-month Prediction (with sub-items for One-month Prediction, Z500, T850 & SLP, Stream Function, Velocity Potential & Surface Air Temperature, Verification, Hindcast Verification, and One-month Guidance Tool), and a Monthly Discussion on Seasonal Climate Outlooks (last updated 19 Sep 2023). A note indicates that the guidance tool is only accessible to registered NMHSs.

Tokyo Climate Center
WMO Regional Climate Center in RA II (Asia)

Home World Climate Climate System Monitoring El Niño Monitoring **NWP Model Prediction** Global Warming Climate in Japan Training Module Press release Links

HOME > Ensemble Model Prediction

JMA's Ensemble Prediction System (Products for Long-Range Forecasting of WMC Tokyo)

JMA, as a WMO World Meteorological Centre (WMC), operates the ensemble prediction system of an atmospheric general circulation model (AGCM) for one-month prediction and atmosphere-ocean coupled general circulation model (CGCM) for three-month and warm/cold season prediction. Ensemble prediction products, verification charts and specification of the ensemble prediction system are available on this page. JMA was designated as a WMC in 2017 and, as a part of its activities, the Centre conducts global numerical long-range prediction (Global Producing Centre for Long-Range Forecast; GPC-LRF)

Notice

- 16 May 2022
Announcement: [Terminating the data provision of CPS2 six-month forecasts](#)
- 14 March 2022
Announcement: [Upgrade of Global EPS for one-month prediction](#)

Main Products

One-month Prediction

- One-month Prediction (28 Sep 2023)
- Z500, T850 & SLP (Northern Hemisphere) (28 Sep 2023)
- Stream Function, Velocity Potential & Surface Air Temperature (60N-60S) (28 Sep 2023)
- Verification (01 Oct 2023)
- Hindcast Verification **NEW !**
- One-month Guidance Tool, Commentary
(Only registered NMHSs can access this guidance tool.)

Monthly Discussion on Seasonal Climate Outlooks

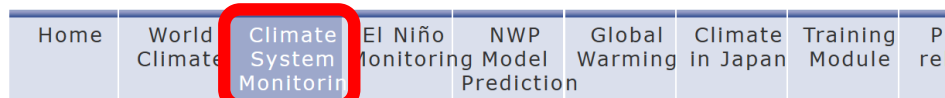
last updated : 19 Sep 2023

This product is intended to assist NMHSs in the Asia-Pacific region in interpreting WMC Tokyo's three-month prediction and warm/cold season prediction products.

<https://www.data.jma.go.jp/tcc/tcc/products/model/index.html>

Climate System Monitoring

- JMA monitors the climate system focusing on atmospheric circulation, tropical convection, oceanographic conditions, and snow cover to understand background factors of the present climate conditions.
- In 2023, the products based on JRA-3Q and the related oceanographic dataset (COBE-SST2 (Hirahara et al. 2014), MGD SST (Kurihara et al. 2006), and MOVE/MRI.COM-G3) were launched in May 2023. The products based on the outgoing longwave radiation (OLR) from January 1991 were also updated to those based on the new dataset (NOAA/CPC Blended OLR).



HOME > Climate System Monitoring

Climate System Monitoring

...

Main Products

Report on Climate System

- ▶ Reports on Specific Events (01 Mar 2024)
- ▶ Monthly Highlights on the Climate System (February 2024)
- ▶ Seasonal Highlights on the Climate System (Winter, December 2023 - February 2024)

Monitoring and Statistical Analysis (Explanation)

- ▶ Analysis Charts and Monitoring Indices
- ▶ Asian monsoon monitoring (28 Mar 2024)
- ▶ Madden-Julian Oscillation (MJO) (28 Mar 2024)
- ▶ Stratospheric circulation (28 Mar 2024)
- ▶ Composite map for El Niño / La Niña and Indian Ocean Dipole events

Monthly Highlights on the Climate System

'Monthly Highlights on the Climate System' has been issued in PDF format since March 2007 as a monthly bulletin.

Highlights in February 2024

- Oceanic indicators that ongoing El Niño conditions in the equatorial Pacific have already peaked are ... on 11 March 2024).
- Monthly mean temperatures were significantly above normal in eastern/western Japan and Okinawa/Amami, and were above normal in northern Japan.
- Convective activity was enhanced over the tropical central Pacific and the western to central parts of the Indian Ocean, and suppressed from the eastern Indian Ocean to Indonesia, and from

Monthly Mean Figures of Atmospheric Circulation and Snow Cover

Field: Northern Hemisphere | Hist/Norm | Hist & Anom |
Element: 850hPa Temperature & Anomaly |
Year: 2024 | Month: 2 |
Oldest: -1 month | +1 month | Latest | Animation | Start | Stop |
Slow | Fast | Time Direction: Forward |

Other figures

- 5-day Mean
- 10-day Mean
- Monthly Mean
- 3-Month Mean
- Time Cross Section

Analysis charts

Monitoring Indices
Oceanographic Conditions

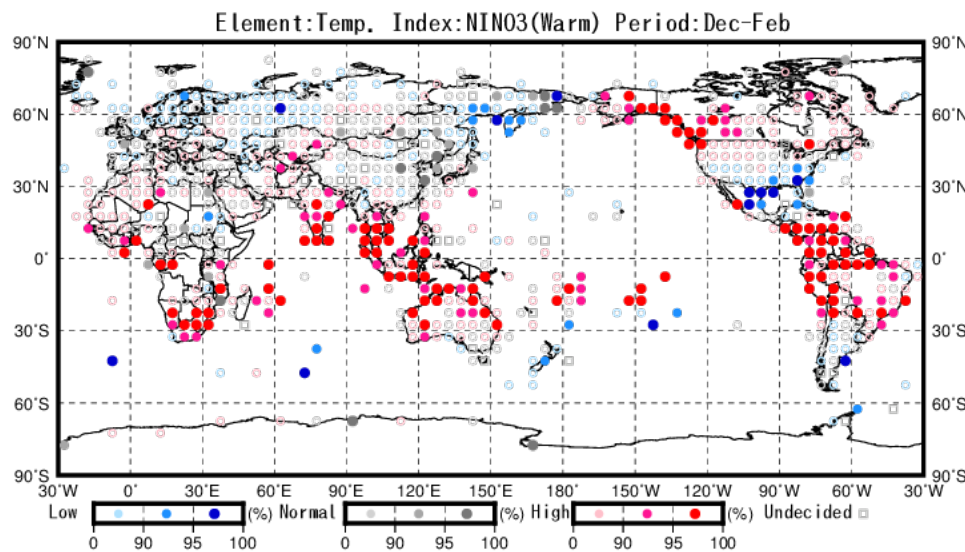
<https://www.data.jma.go.jp/tcc/tcc/products/clisys/>

Assessment of ENSO's impact on the climate

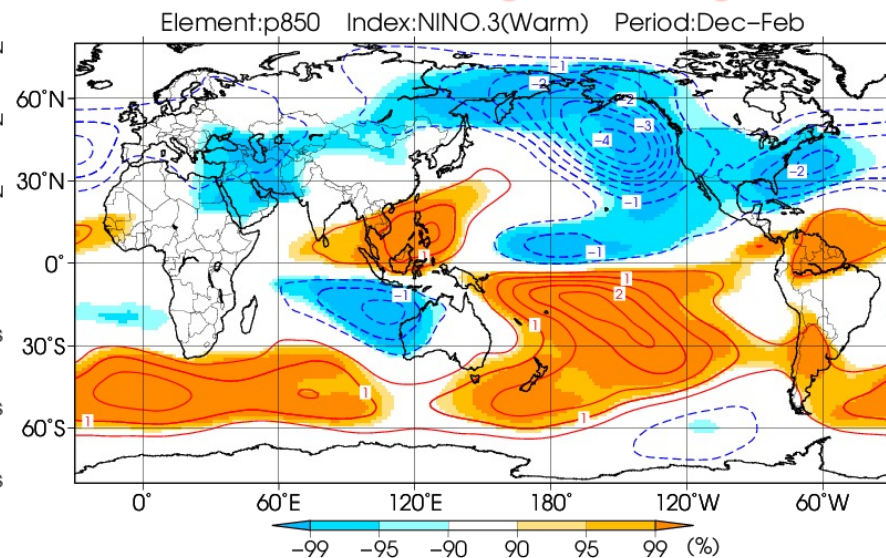
- To promote the understanding of the influence of ENSO on the global climate system, TCC provides statistical analysis results using the observation (CLIMAT reports) and the reanalysis data.
- In 2023, TCC updated the statistical results based on the new reanalysis dataset of JRA-3Q, which covers the period from 1948 to 2021.

Composite anomalies in DJF in El Nino years

Surface temperature anomalies (CLIMAT reports)

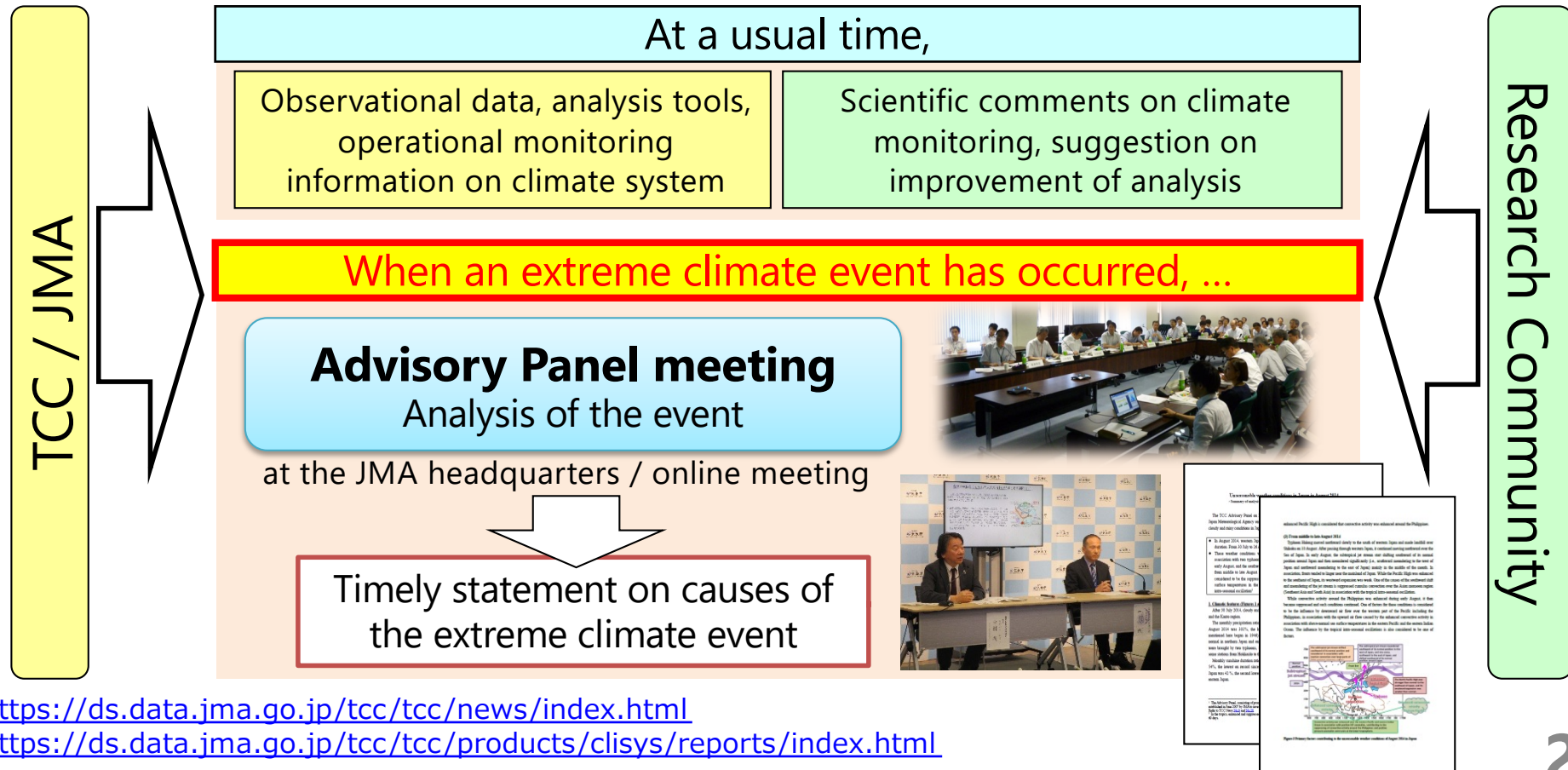


850hPa stream function anomalies (JRA-3Q)



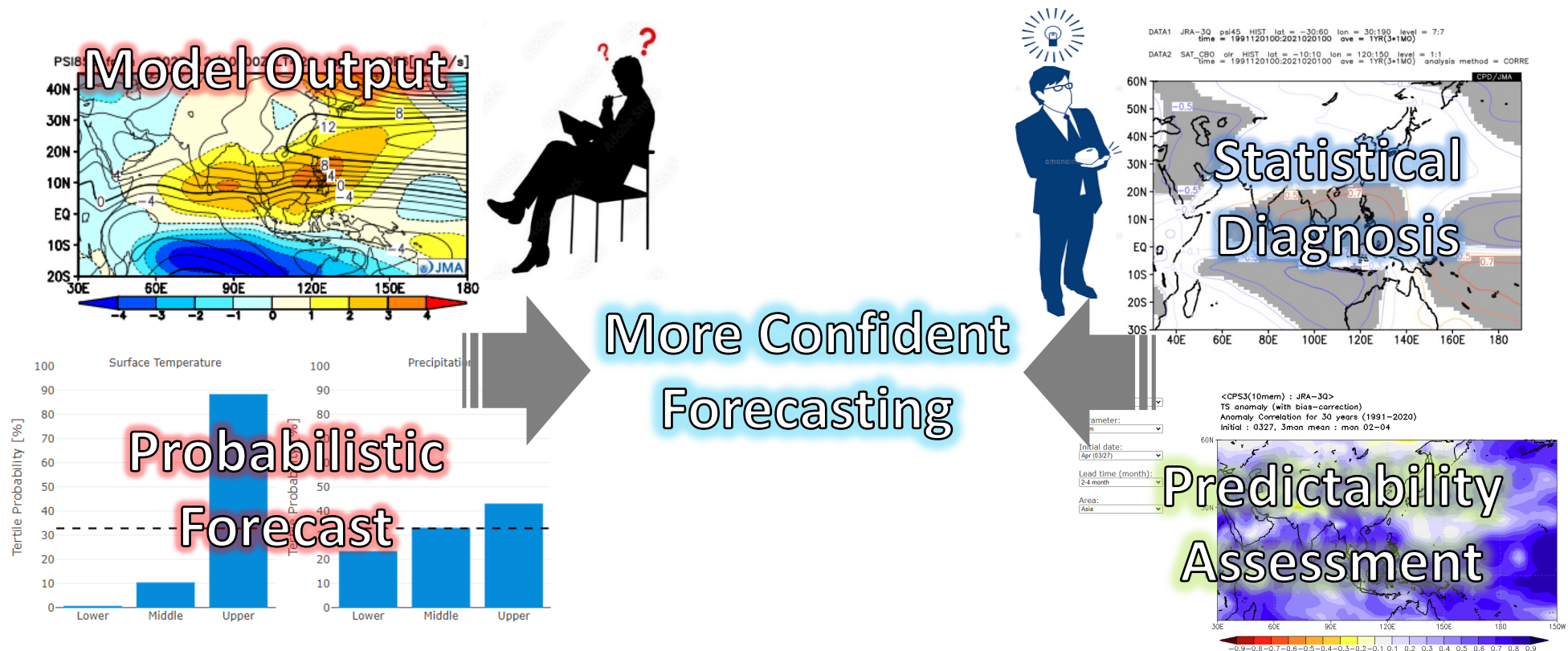
TCC Advisory Panel on Extreme Climate Events

- JMA routinely shares information on the current conditions of the climate system with the TCC Advisory Panel on Extreme Climatic Events, a JMA body staffed by prominent climate science experts. When an extreme climate event has occurred, JMA holds the advisory panel meeting and timely states on the primary factors.
- In 2023, JMA held the temporary meeting on 28 August 2023 to identify possible factors behind heavy rainfall during the rainy season and extremely high temperatures from mid-July onward in Japan.



TCC Capacity Development Activities

- TCC conducts annual training seminar on such as climate analysis and seasonal forecasts to NMHSs in Asia and Pacific regions as the capacity development activities.
- Our seminars are designed to provide essential expertise for conducting operational seasonal forecasts with emphasis on dynamical interpretation and assessment of forecast model outputs.



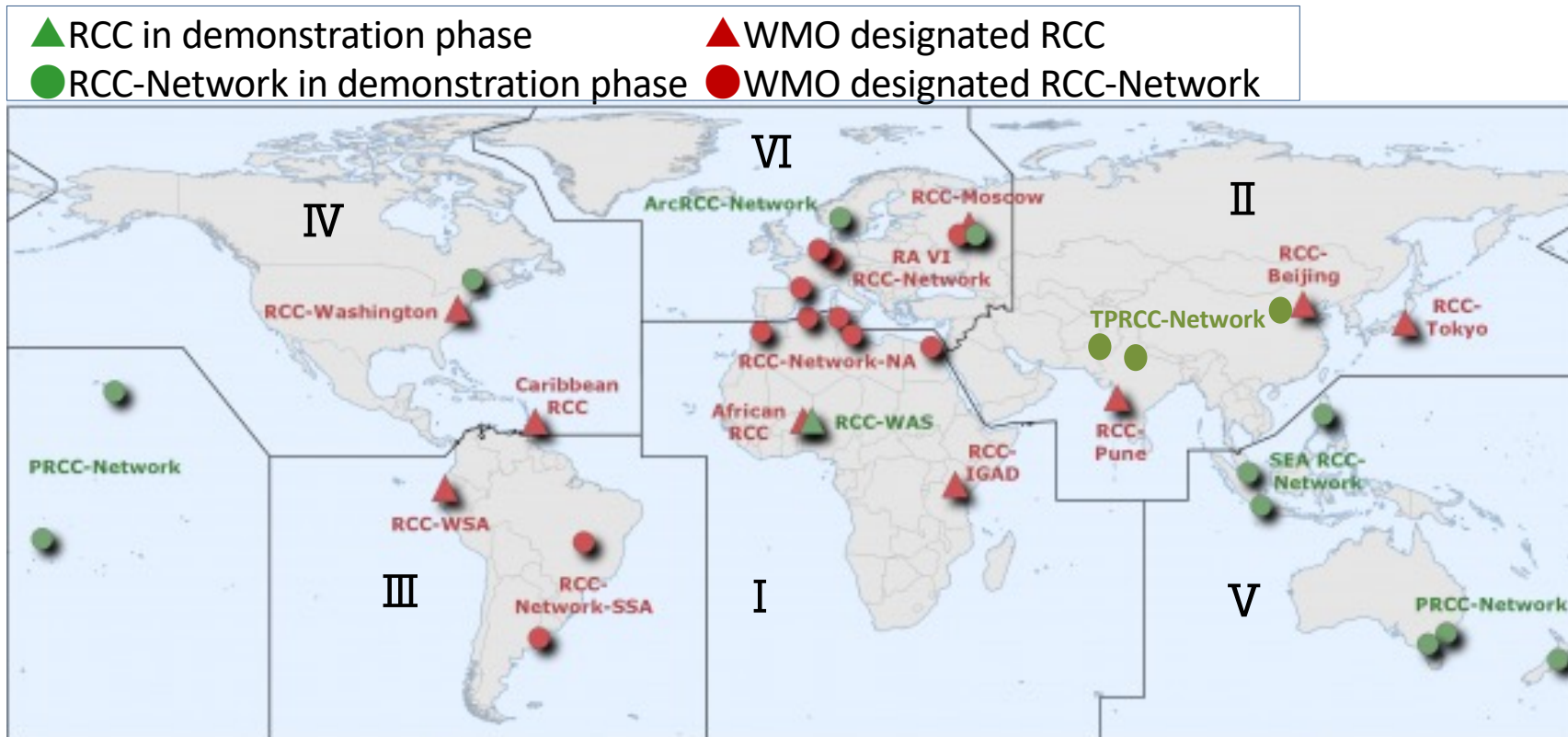
<https://www.data.jma.go.jp/tcc/tcc/library/index.html>

Regional Climate Center (RCC)

WMO Regional Climate Centers (RCCs) are centers of excellence that create regional climate products.

- RCCs are middle tier in a three-tiered WMO operational infrastructure
- RCCs strengthen the capacity of WMO Members in each region to generate and deliver the best climate services to national users
- RCC regional products include climate data sets, monitoring products and long-range forecasts.

Current status of establishment of RCC



Designation step for RCC or RCC-Network

Rough procedures for designation of RCC

Step0: **expresses an intention to establish an RCC (RCC candidate)**

Step1: apply P/RA to **begin a demonstration phase with an implementation plan**

Step2: P/RA will assess the implementation plan and inform WMO

Step3: The candidate will **implement the demonstration phase**

Step4: The candidate will submit a status report of the demonstration phase

Step5: **Evaluation of the demonstration phase achievement**

Step6: **Designation as RCC**

An example

Third Pole(TP)-RCC Network Establishing Group
at WMO HQ Geneva Switzerland

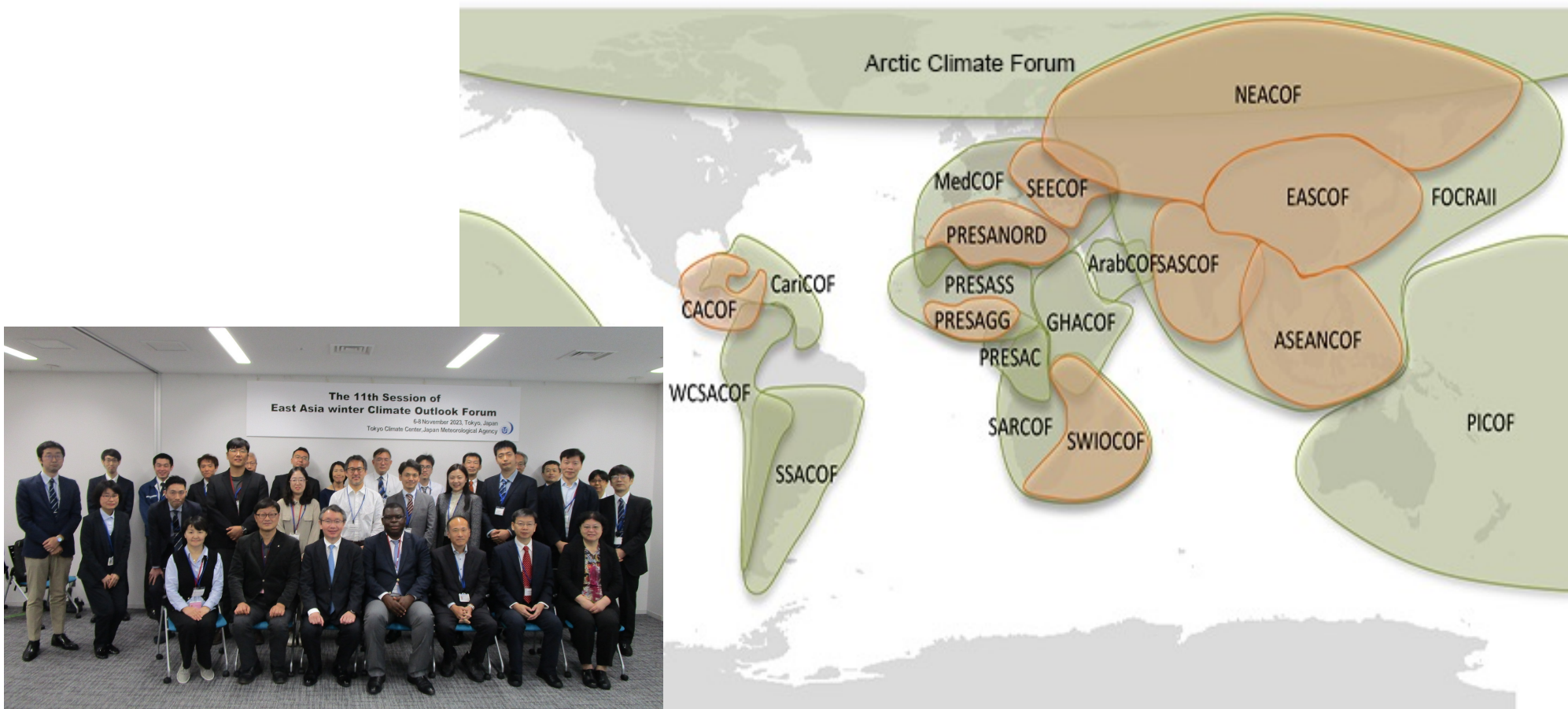
March 27-28, 2018

Demonstration phase has started in early 2022.

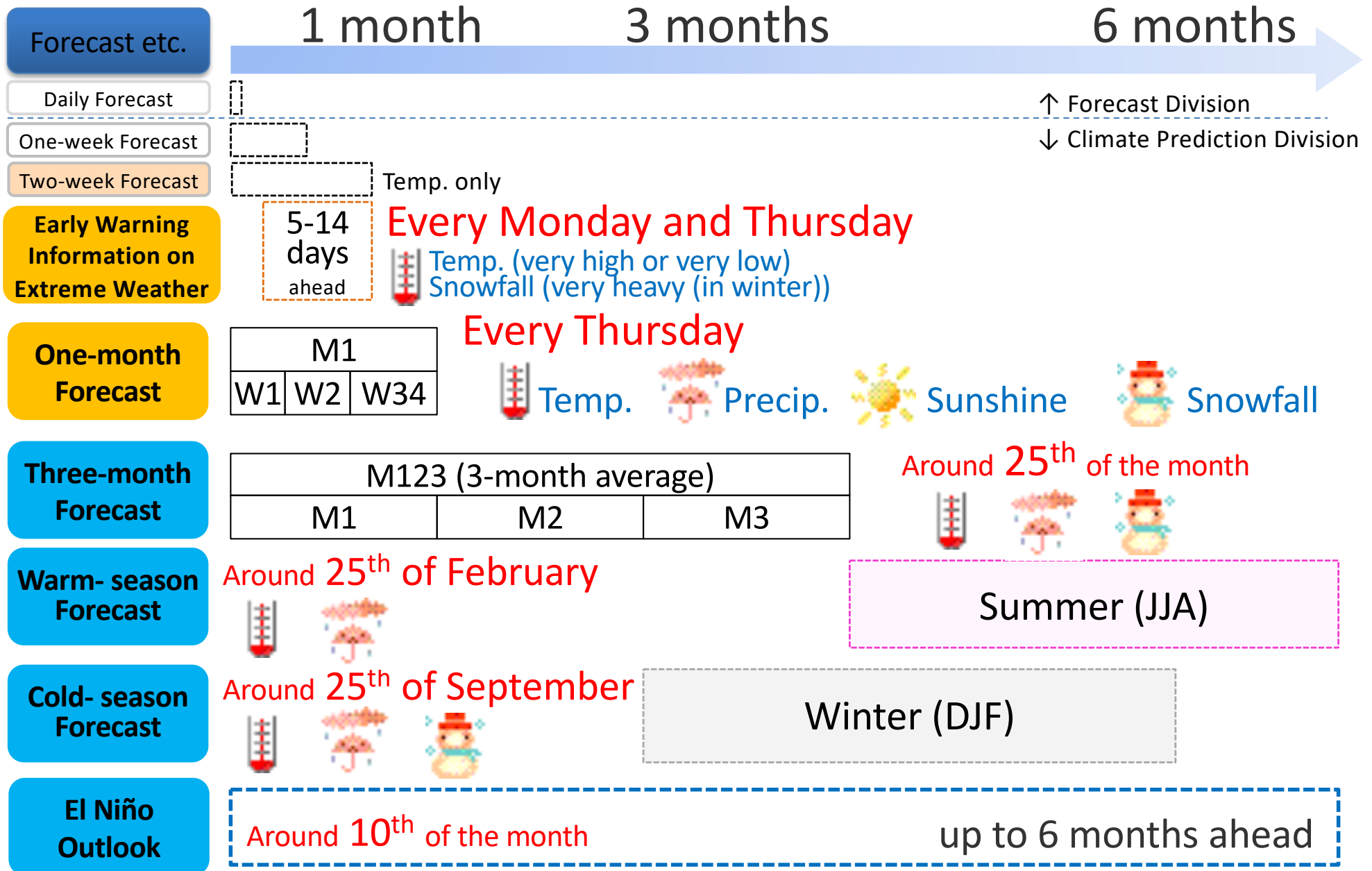


Regional Climate Outlook Forums(RCOFs)

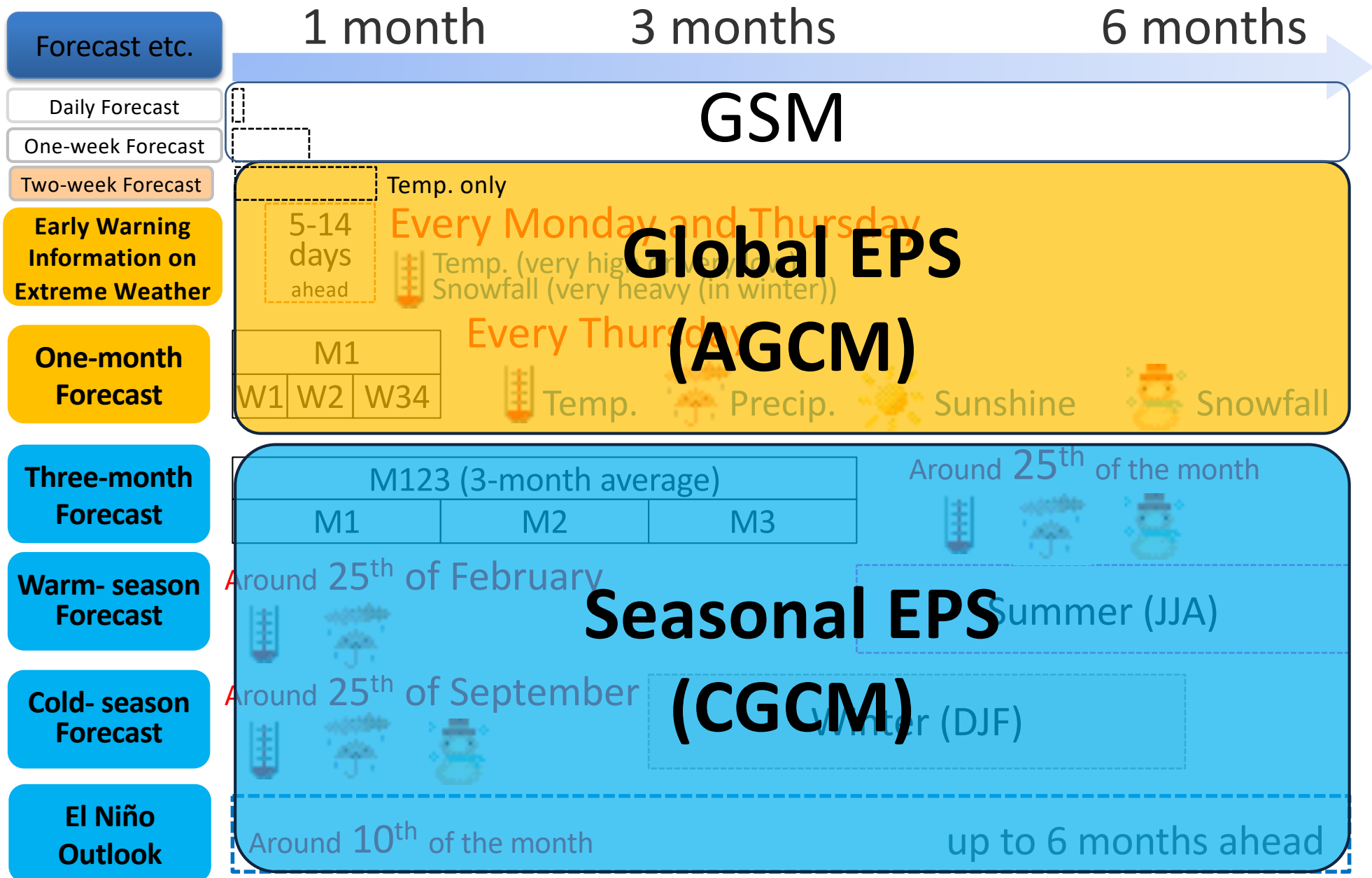
RCOFs produce **consensus-based, user-relevant climate outlook products** in real time in order to reduce climate-related risks and support sustainable development for the coming season in sectors of critical socioeconomic significance for the region in question.



Seasonal forecast issued by JMA (domestic)



Seasonal forecast issued by JMA (domestic)



Animation map for one-month prediction

Animation for one-month prediction (7-days running mean)

This product is displayed for use by National Meteorological and Hydrological Services (NMHSs). It does not constitute an official forecast for any nation.

Initial date: 2023.09.27 Forecast lead time: Day -11

Setting for Animation

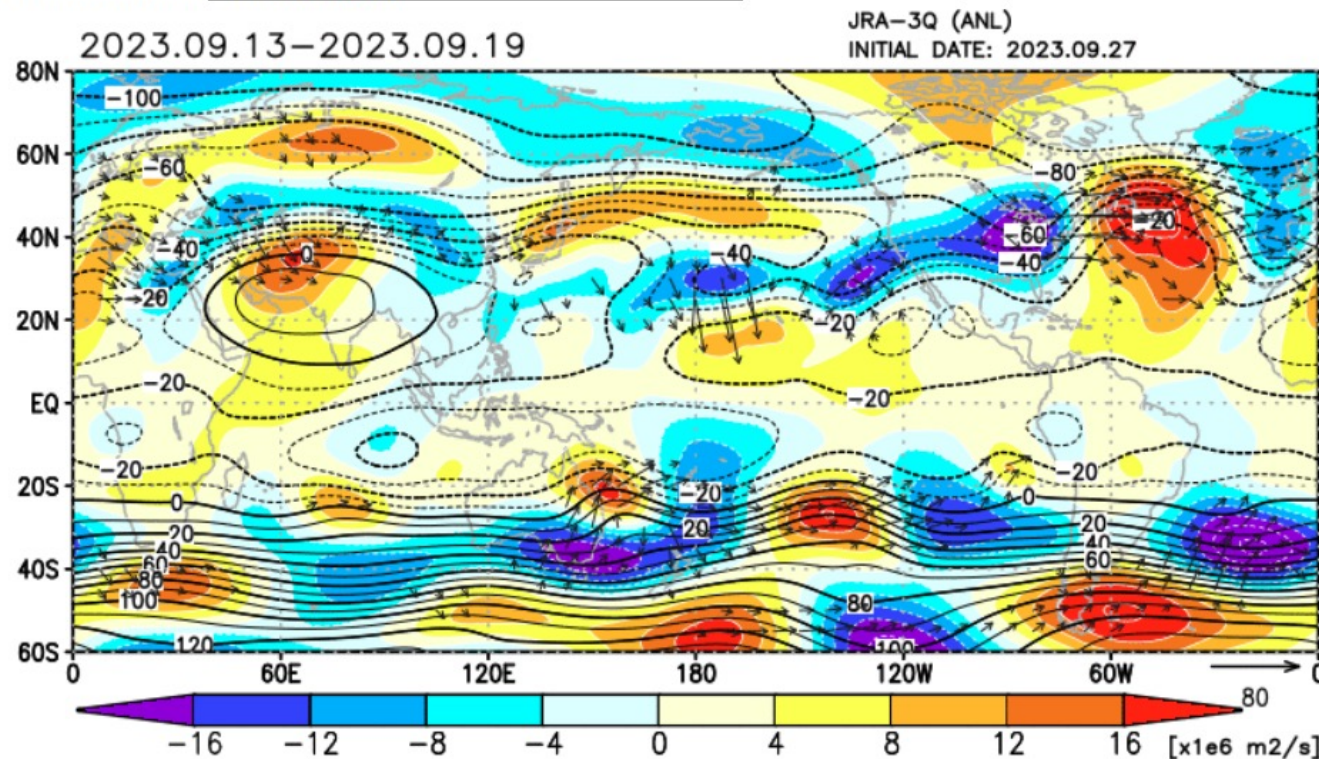
Oldest (lead Day -11) -1 day Initial +1 day Termination (lead Day +28)

Animation: Start Stop

<< (Slow) >> (Fast)

week-1 week-2 week-3 week-4

Parameter: PSI200 (Tropics)

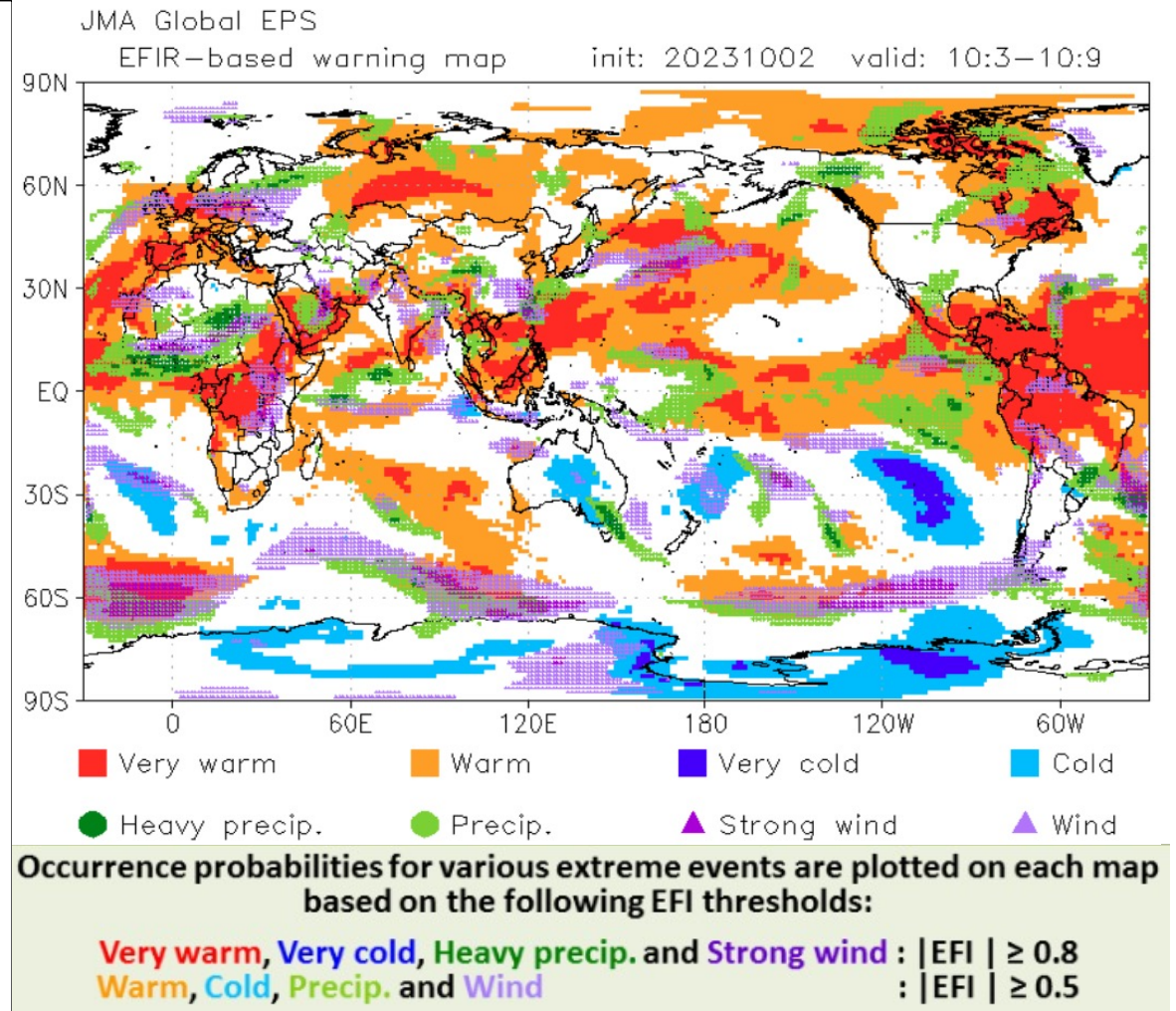


Forecast Products in Support of Early Warnings for Extreme Weather Events

This forecast products are prepared on the basis of Extreme Forecast Index (EFI), which is a measure of the difference between the probability distribution of a real-time forecast and a climatological distribution.

On the web page, available forecast products are geographical distribution (global and Asia) maps of

- Extreme Forecast Index (EFI),
- Extreme weather warning based on EFI,
- Probability above/below the 90th/10th percentile of the model climatology for covering the period up to two weeks ahead. This is updated everyday.



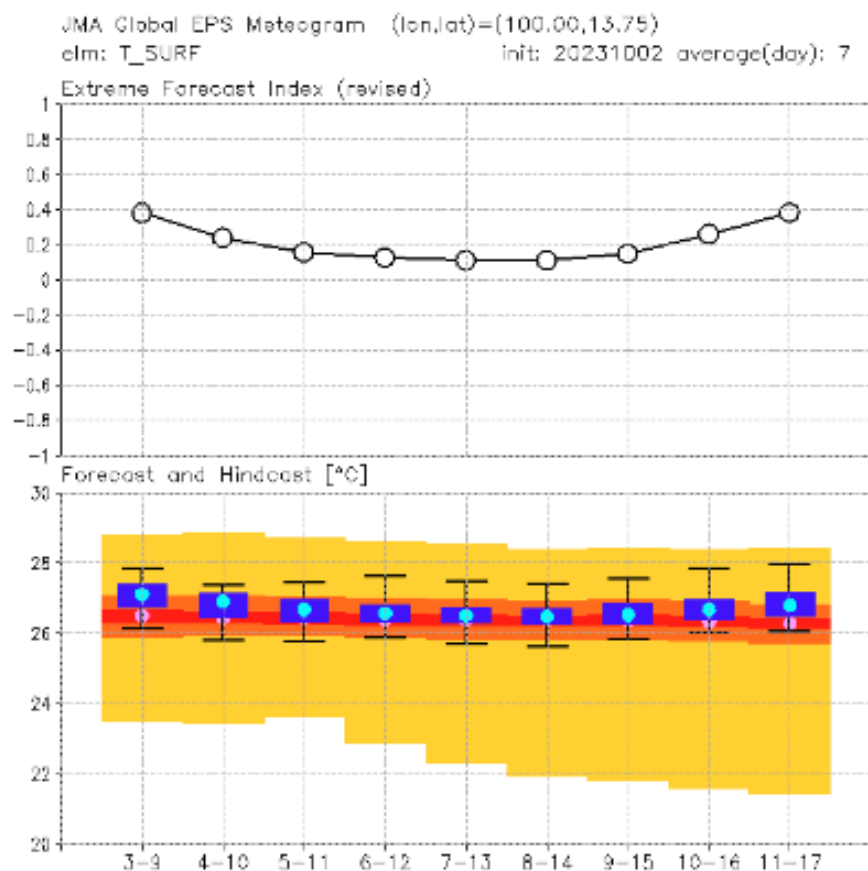
This product is available for NMHSs.

(Password Protected) <https://www.data.jma.go.jp/tcc/tcc/gpv/EFI/index.php>

Forecast Products in Support of Early Warnings for Extreme Weather Events

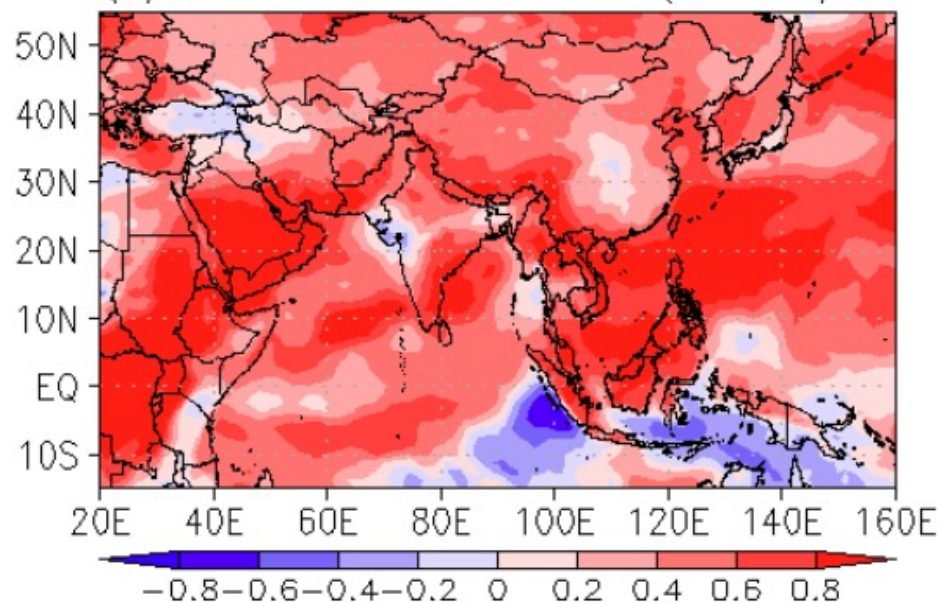
Initial date: 2023.10.02 / Forecast lead time: Day +1 / 7-day mean /

Element Surface temperature / Area(map) ASIA / Point(meteogram) BANGKOK(100.00E,13.75N) *Refer to the nearest grid point.



JMA Global EPS elem: T_SURF

(a) Extreme forecast index(revised)



Forecast



Climate



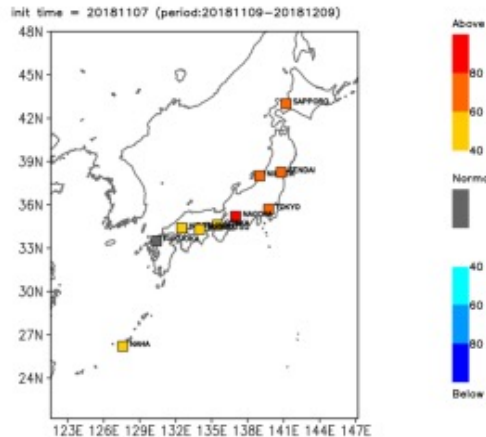
(Password Protected)

<http://www.data.jma.go.jp/tcc/tcc/gpv/EFI/index.php>

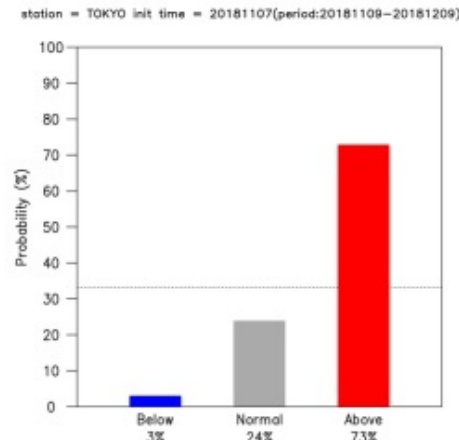
(top) Time series of EFI values.

(bottom) Time series of the EPS forecast (cold color) and the model climate (warm color).

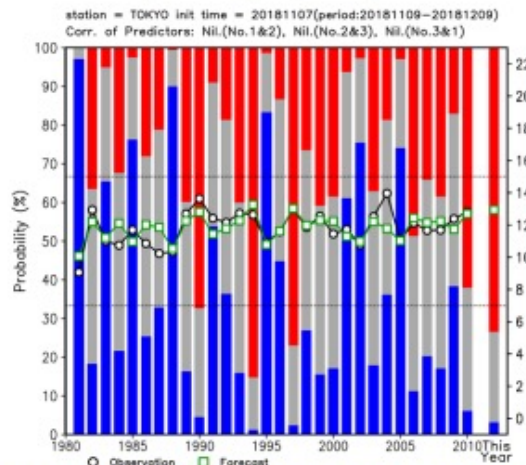
One-month Guidance Tool



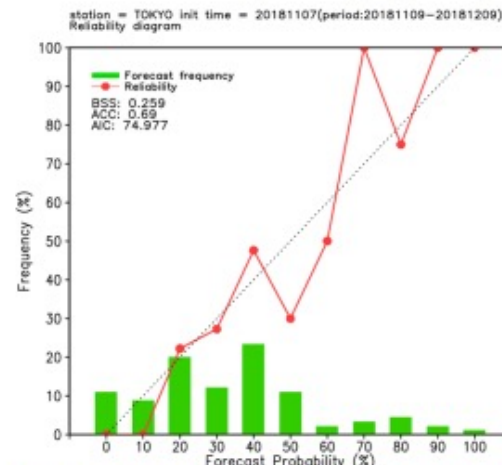
Sample temperature probability forecast map for each category. Cool-, grey- and warm-colored marks denote below-, near- and above-normal probability, respectively.



Sample temperature probability forecast for three categories. Blue, grey and red bars denote below-, near- and above-normal probability, respectively.



Sample temperature probability forecast for three categories. Blue, grey and red bars denote below-, near- and above-normal probability, respectively. Black and green lines are inter-annual timeseries representations of daily-mean observation and forecast anomaly data, respectively.



Sample reliability diagram. Red lines show reliability and green bars show forecast frequency.

TCC provides a web-based One-month Guidance Tool.

- Available via a web browser
- Provide three-level (tercile) probabilistic forecasts at specified points
- Forecast target: 2mT & total-P
- Max points: 10 points
- Outputs are four-type figures and CSV files
- Only registered NMHSs can access this guidance tool with password-protection

jica_2023/JICA2023

Valid by the end of 2023

https://extreme.kishou.go.jp/tool/simple_guidance/help/

(Password Protected) https://extreme.kishou.go.jp/cgi-bin/simple_guidance/index.cgi

Provision of Binary gridded data

Download Gridded Data File

Notice

- 16 May 2022
Announcement: [Terminating the data provision of CPS2 six-month forecasts](#)
- 28 December 2021
Announcement: [Schedule for terminating the data provision of CPS2](#)
- 15 September 2020
Announcement: [Improvement of Extreme Forecast Index \(EFI\) products](#)
- 16 April 2020
Announcement: [Release of Global Gridded Datasets for 6-month Forecasts](#)

Main Products

NWP Model Prediction

Global EPS for one-month prediction (28 Sep 2023)

High resolution data; 1.25 degree grid **NEW**

- › [Daily Statistics \(1.25 degree grid\)](#)
- › [All Members \(1.25 degree grid\)](#)
- › [Systematic Errors \(1.25 degree grid\)](#)

Seasonal EPS for six-month prediction (CPS3) **NEW** (03 Oct 2023)

- › [Statistics](#)
- › [All Members](#)
- › [Indices](#)
- › [Systematic Errors](#)

Hindcast Gridded Data

Global EPS for one-month prediction
NEW

- › [Daily data \(1.25 degree grid\)](#)

Seasonal EPS (CPS3) **NEW**

- › [Monthly mean data](#)

Animation of One-month Prediction

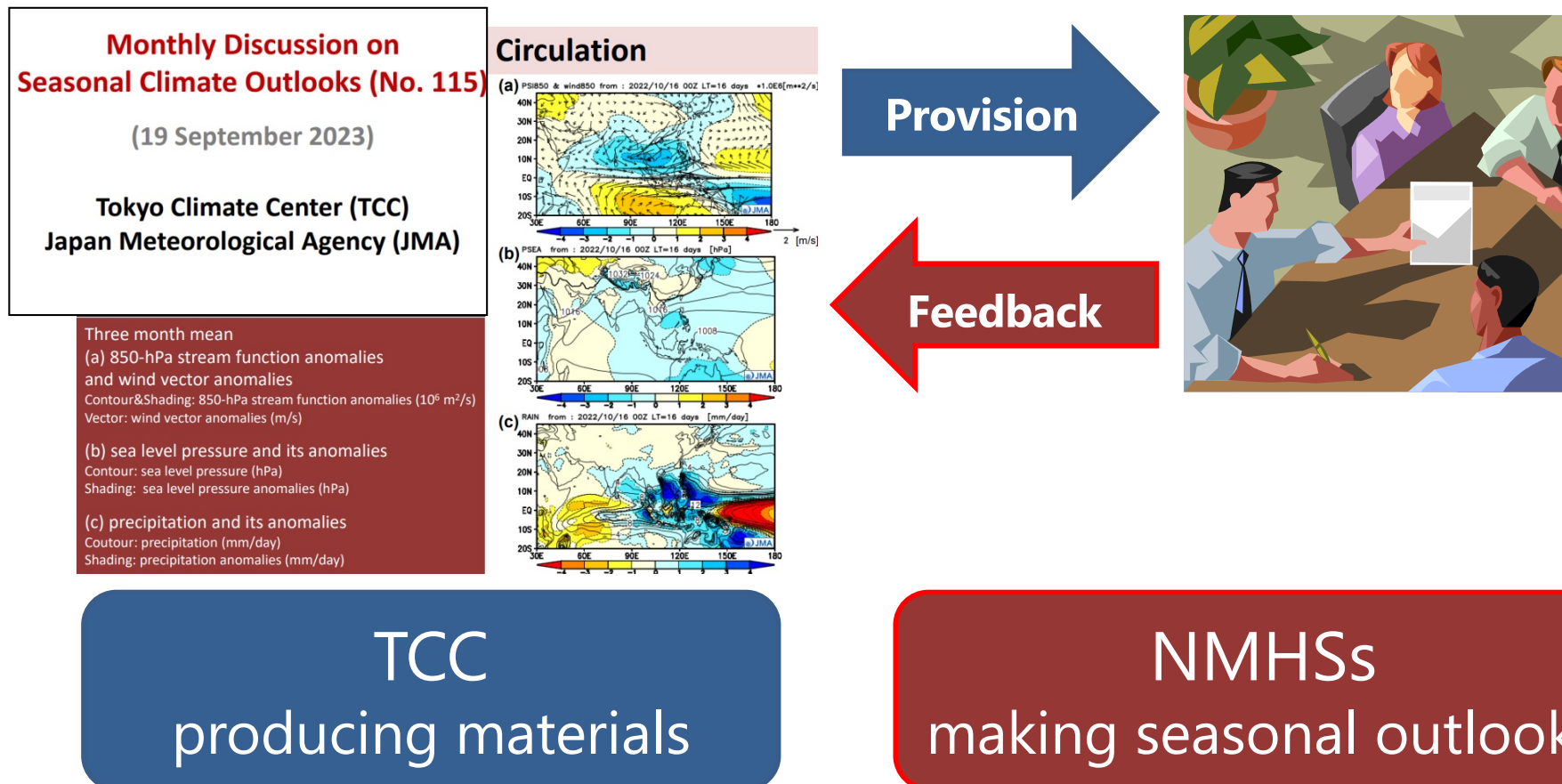
- › [Seven-days running mean](#) **NEW** (28 Sep 2023)

Tips

- › [Q&A](#)

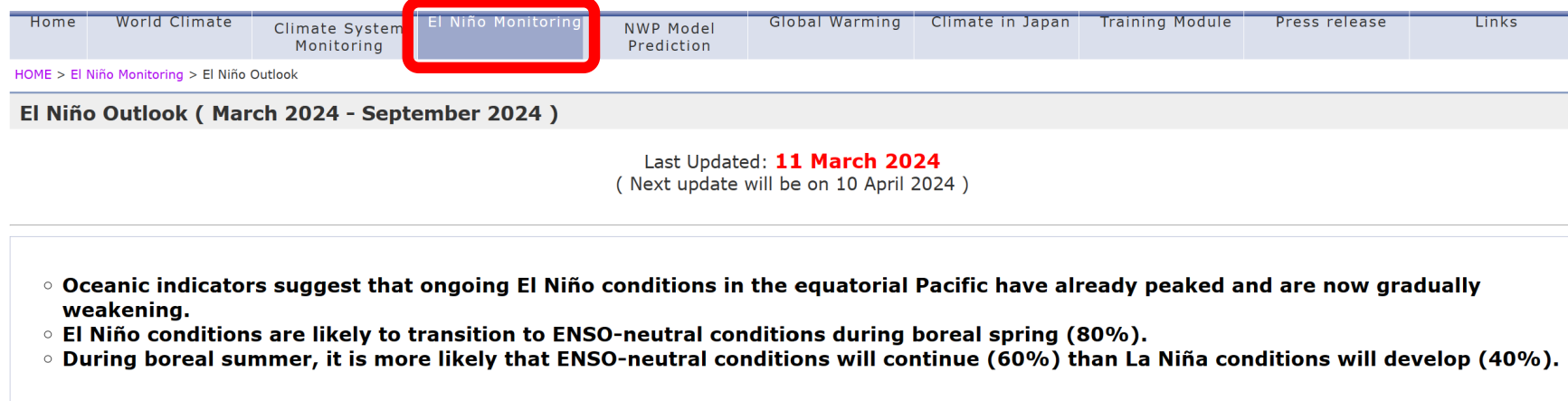
Monthly Discussion on Seasonal Climate Outlook

- “Monthly Discussion on Seasonal Climate Outlook” issued every month around the 25th is intended to assist NMHSs in the Asia-Pacific region in interpreting GPC-LRF Tokyo's three-month prediction and warm/cold season prediction products.

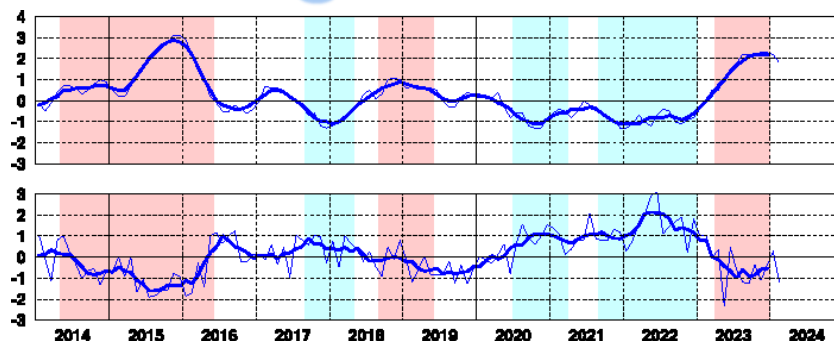


TCC's El Niño monitoring and prediction

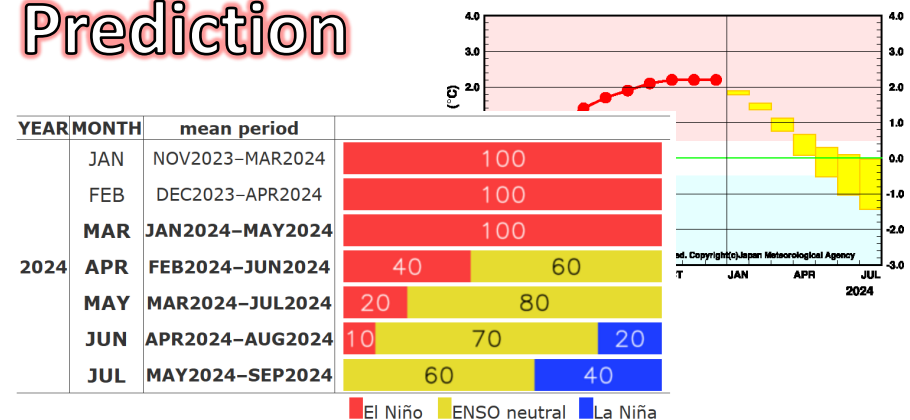
- JMA operates the Ocean Data Assimilation System and the El Niño Prediction System (an ocean-atmosphere coupled model) for ENSO monitoring and prediction.
- El Niño outlooks are updated every month around the 10th.



Monitoring



Prediction



<https://www.data.jma.go.jp/tcc/tcc/products/elnino/index.html>

<https://www.data.jma.go.jp/tcc/tcc/products/elnino/outlook.html>

Global climate with CLIMAT and SYNOP report and climate monitoring activity

World Climate: <https://www.data.jma.go.jp/tcc/tcc/products/climate/index.html>
Climate System Monitoring: <https://www.data.jma.go.jp/tcc/tcc/products/clisys/index.html>

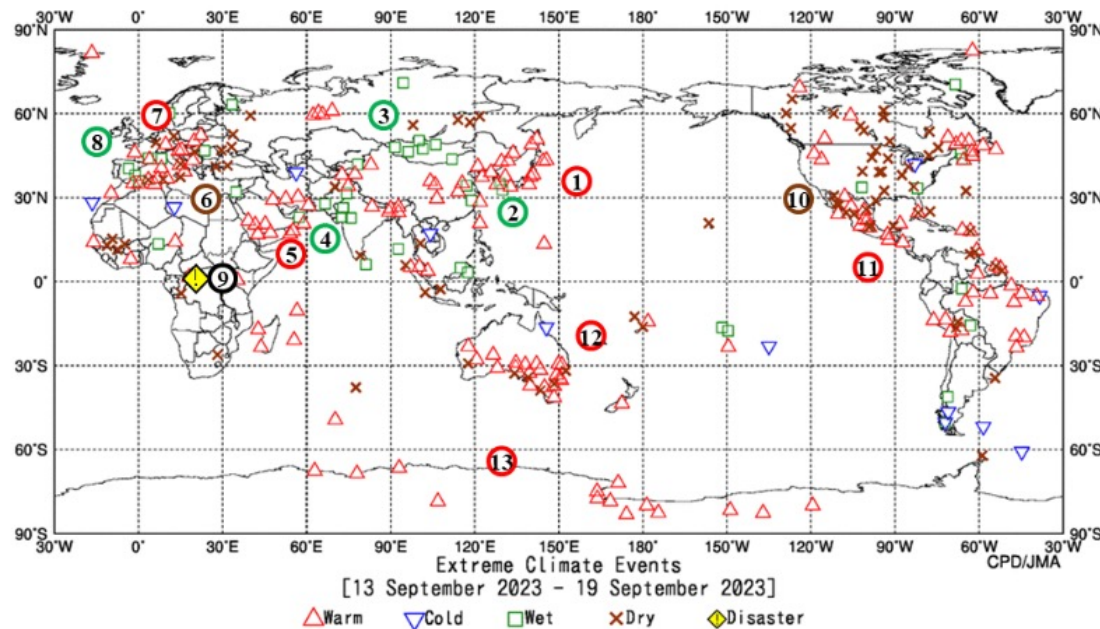
The screenshot shows the Tokyo Climate Center (TCC) website. The header includes the JMA logo and the TCC title. The navigation menu has links for Home, World Climate, Climate System Monitoring, El Niño Monitoring, NWP Model Prediction, Global Warming, Climate in Japan, Training Module, Press release, and Links. A blue box highlights the 'World Climate' and 'Climate System Monitoring' links. A blue arrow points to the 'Main Products' section, which includes 'iTacs' (Interactive Tool for Analysis of the Climate System) and 'GPC Tokyo' (Global Producing Center). The 'What's New' section on the right lists recent updates, including the 2015 edition of the Climate Change Monitoring Report and figures on Global Average Surface Temperature Anomalies.

Weekly monitoring products on climate extreme

Weekly Report on Global Extreme Climate Events

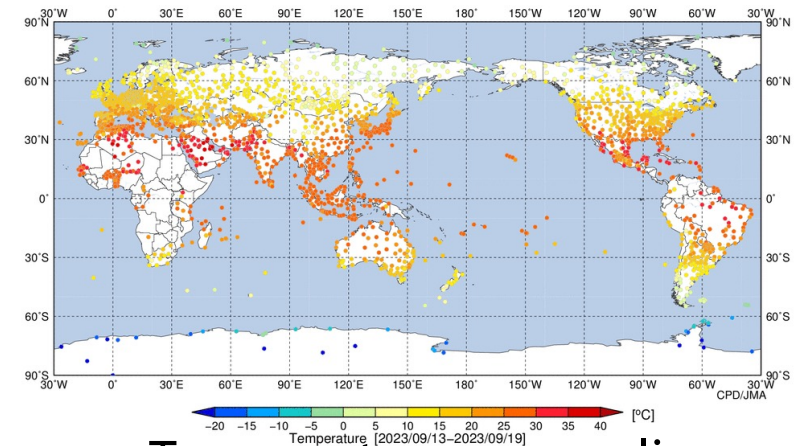
Period: < > Show Figure:

Extreme climate events and weather-related disasters during this period

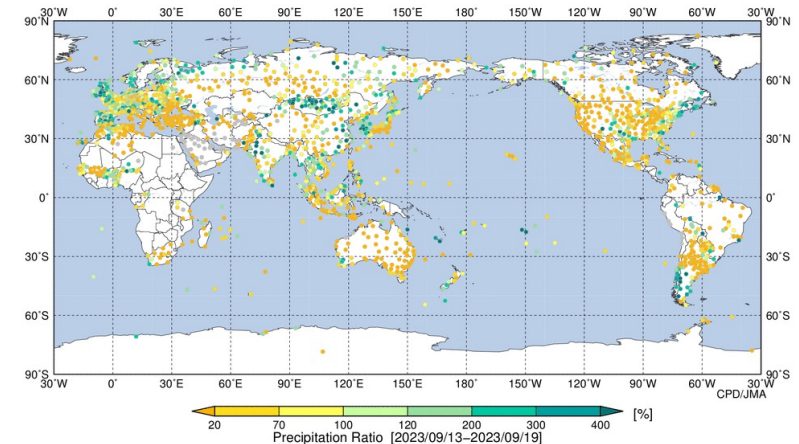


	Type	Area	Remarks
1	Warm	From southern Eastern Siberia to central China	
2	Wet	From the southern Korean Peninsula to eastern China	
3	Wet	Mongolia	
4	Wet	From northwestern India to Oman	<ul style="list-style-type: none"> It was reported that heavy rains caused at least 40 fatalities in India (the

Update
Every Wednesday

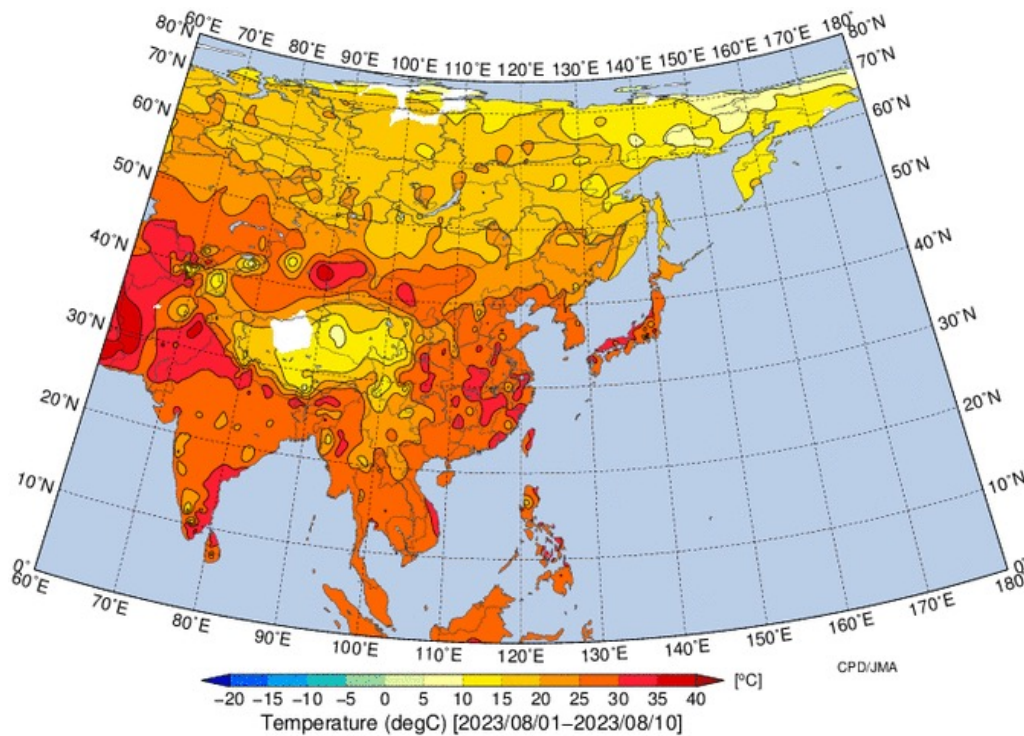


Temperature anomalies



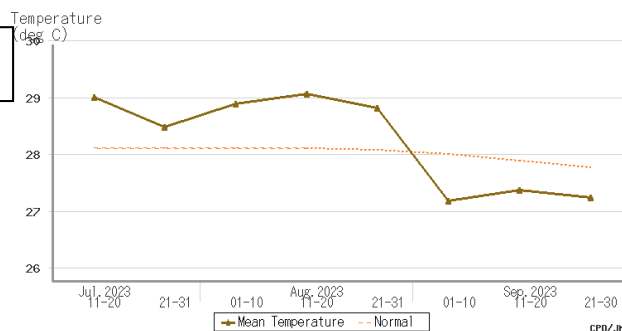
7-day precipitation ratios

10-day/half monthly temp./prec. products



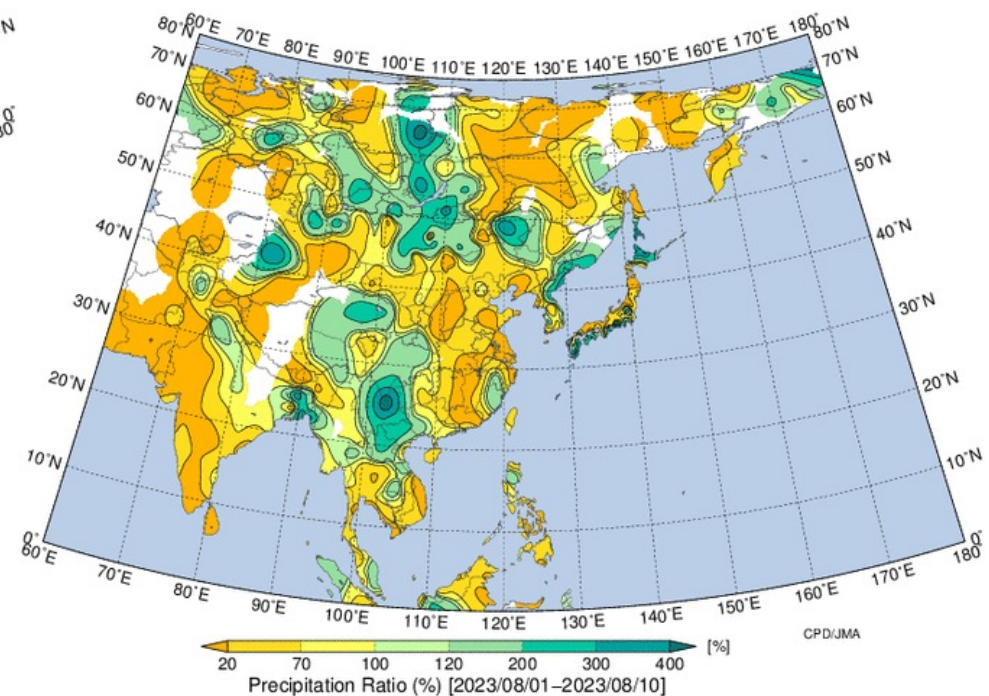
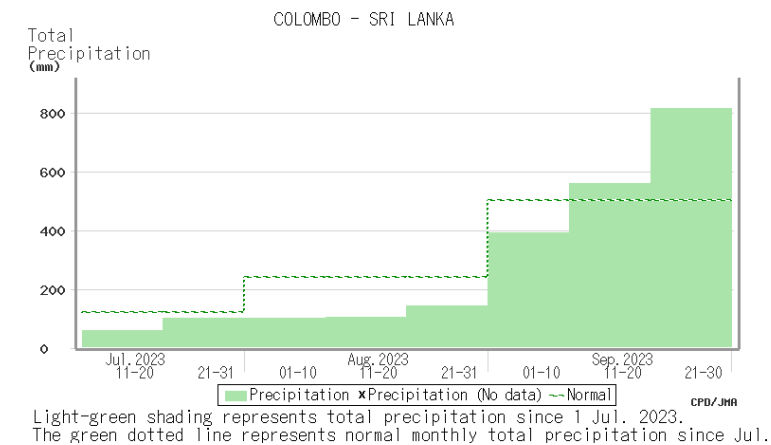
COLOMBO - SRI LANKA

Temperature



Update

- 10-day: Every month at 1st,11th,21st
- Half-month: Every month at 1st,16th

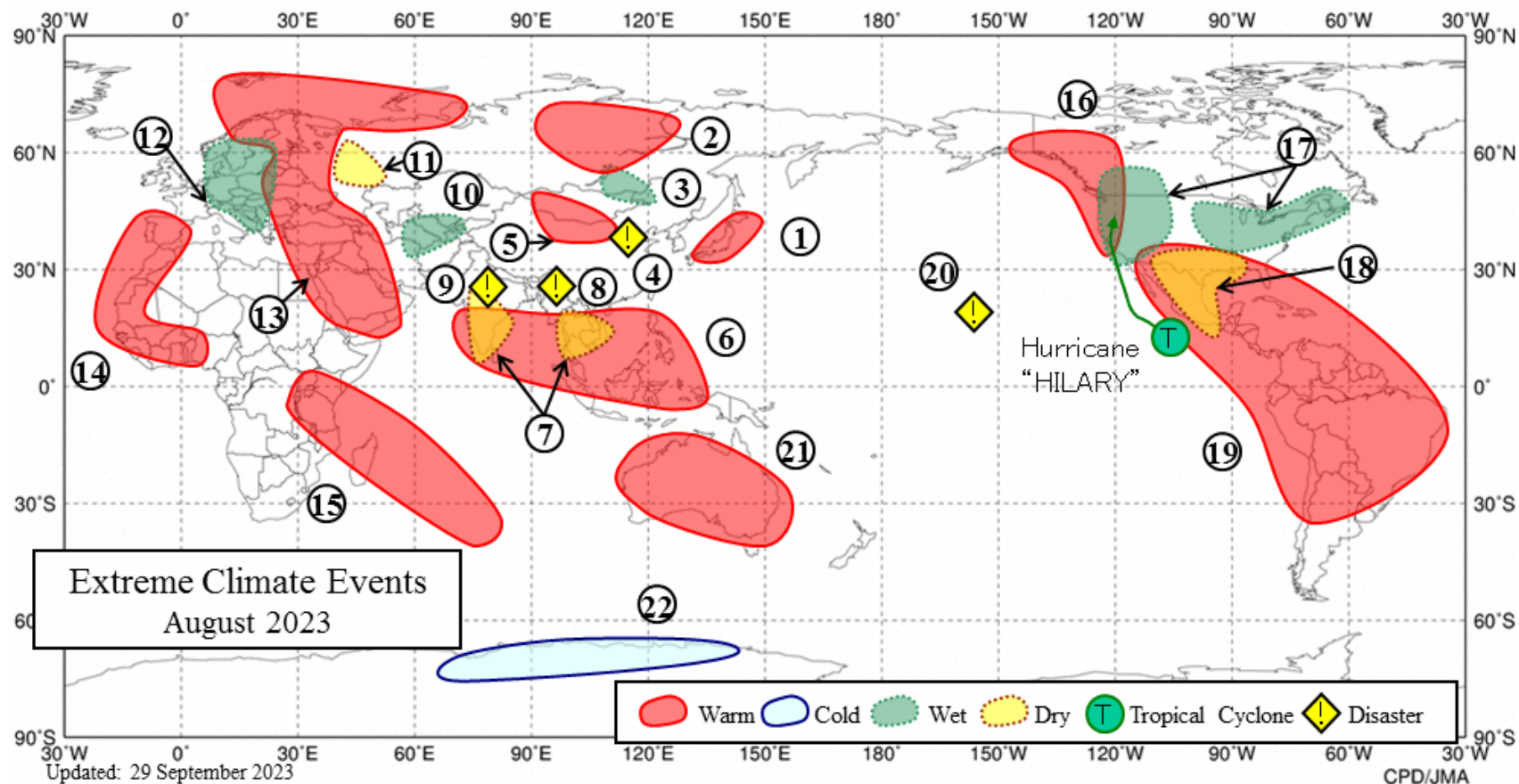


Precipitation ratio

Extreme climate monitoring

TCC issued weekly, monthly, seasonal and annual temperature/precipitation/hazardous climatic events (flood/drought/tropical cyclone) report using CLIMAT and SYNOP reports

Distribution of Monthly Extreme Climate Events (August 2023) based on CLIMAT



ClimatView : monthly base

Powerful tool overviewing and downloading monthly world climate data. It allows the user to see and obtain monthly mean temperatures, monthly total precipitation amounts, its anomaly/ratio and SPI at all available stations.

ClimatView - a tool for viewing monthly climate data

The ClimatView tool enables viewing and downloading of monthly world climate data, including monthly temperature/precipitation statistics and 30-year climate normals. Data are available for the period since June 1982, when JMA started receiving CLIMAT messages. Click on a station to see the relevant monthly data chart.

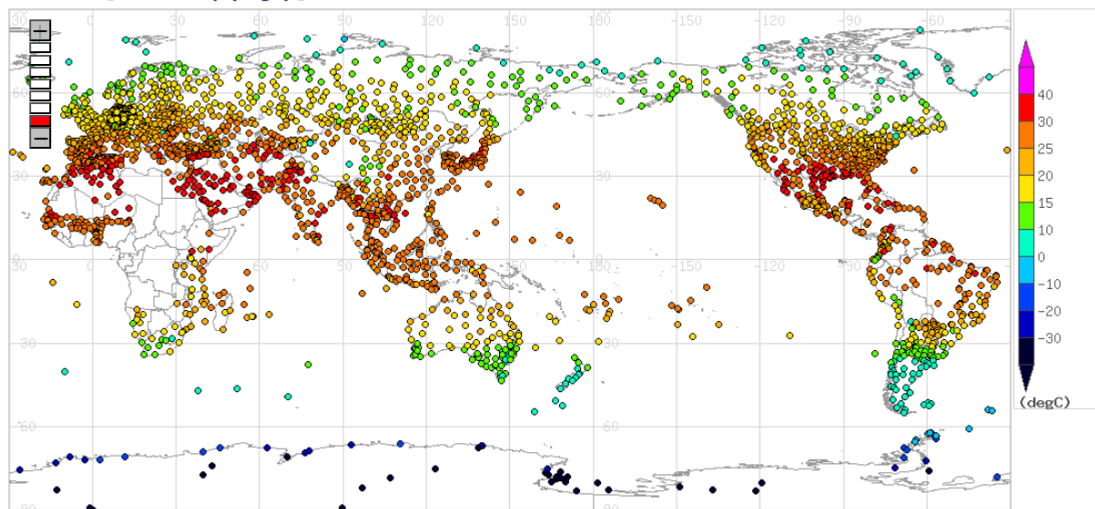
[Outline of ClimatView](#) [Commentary on SPI](#)

Search Form

Region: Element: Year/Month: Map Reso. ☒ High ☐ Low

[Data List](#) [Printable](#) Click the "Show" button to reflect elements selected via the drop-down lists and radio button.

2023-08: [Mean Temp.(degC)]



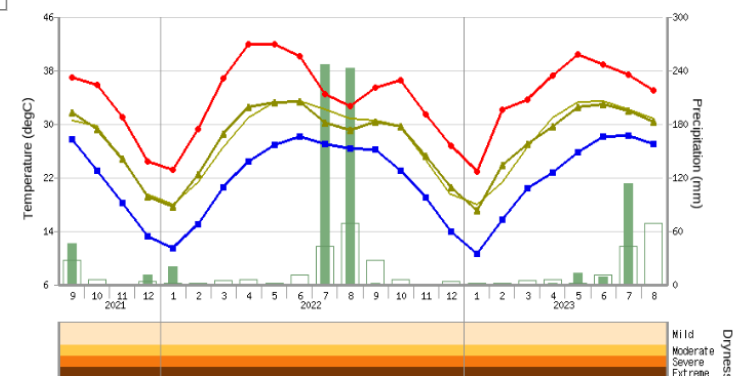
Monthly data --- chart/table

Search Form

Year/Month: Term: SPI time scale:

[Map](#)

HYDERABAD [PAKISTAN]



Upper panel: time series graph for temperature and precipitation
 — Mean Temp. — Max Temp. (Monthly Mean) — Min Temp. (Monthly Mean) — Mean Temp. Normal
 x No data (for Precip.)
 Lower panel: time series graph for SPI indices
 — SPI 3-Month — SPI 6-Month — SPI 12-Month
 (Note) Value exceeding 0 is plotted on the upper boundary, whereas below -2.5 on the lower boundary

HYDERABAD -PAKISTAN
 Lat.: 25.38 °N / Lon.: 68.42°E Height: 28(m)

[download](#) ----download in csv file

Year/Month	Observation			Normal		SPI		
	Mean Temp. [degC]	Max. Temp. (Monthly Mean) [degC]	Min. Temp. (Monthly Mean) [degC]	Precip. [mm]	Mean Temp. [degC]	Precip. [mm]	3- Month	6- Month
2021-09	31.7	36.9	27.7	46	30.5	27.1		
2021-10	29.3	35.8	23.0	0	29.6	5.8		

Time series of monthly max/mean/low Temp, monthly Precip and Standard Precip Index with 1, 2,5 and all years

<http://www.data.jma.go.jp/gmd/tcc/tcc/products/climate/climatview/frame.php>

ClimatView : daily base only in Japanese

Daily data version

- mean/max/min Temp & daily amount of precipitation
- ~2500 stations

世界の天候データツール (ClimatView 日別値)

世界の天候データツール(ClimatView 日別値)では、世界各国の気象機関から1日に数回送られてくる「地上実況気象通報」をもとに、気象庁で計算した世界各地の毎日の気温(日平均、日最高、日最低)と日降水量が確認できます。日本を除く全国各地のデータは世界協定時(UTC)の0時を1日の区切りとしているため、**各国の気象機関が発表する公式な値とは異なる場合があります。**以下の世界地図には約2500地点の代表的な観測地点が表示されており、図の観測地点のマークをクリックすると選択した地点のグラフと表を表示します。すべての観測地点のデータを取得するには「全データダウンロード」機能をご利用ください。②使用方法について ②ページの表示が極端に遅い場合について ②日データの計算方法について

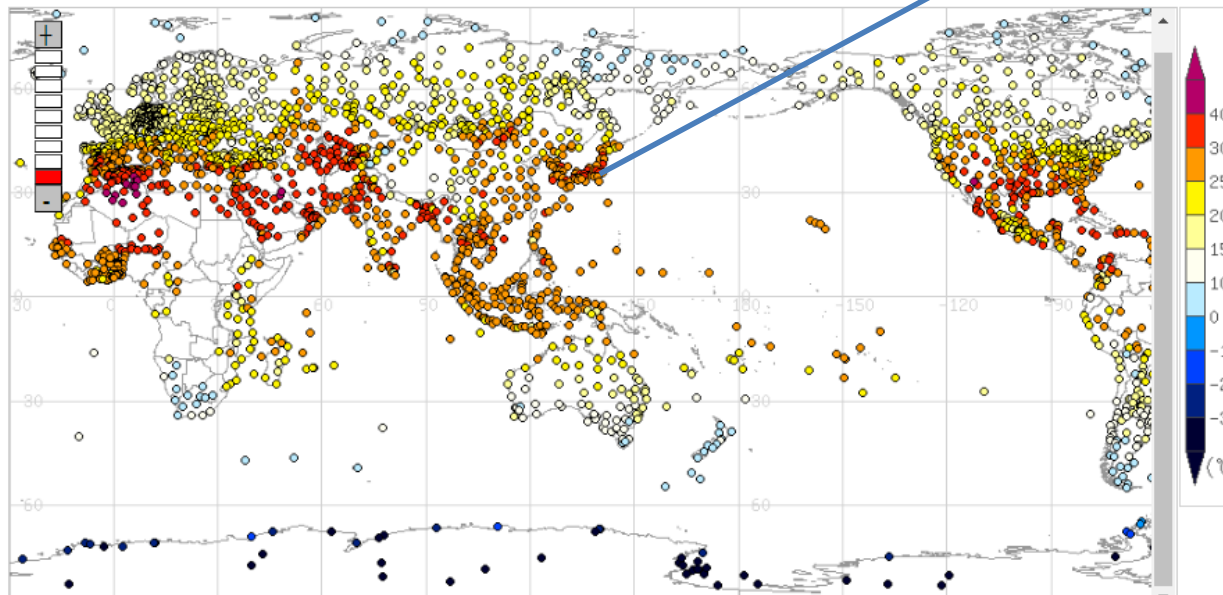
地域・年月日選択フォーム

地域: 世界 要素: 日平均気温 <<<年 <<月 <日 2023 年 7 月 30 日 日>> 月>> 年>> 最新
地図解像度 高 低 表示
データリスト表示 >> 印刷用画面 >> 全データダウンロード >> データリスト表示、印刷用画面、全データダウンロードボタンは、表示ボタンを押してからご利用ください。
月統計値マップの表示(新しいウィンドウが開きます)>>

国・領域別地点検索フォーム

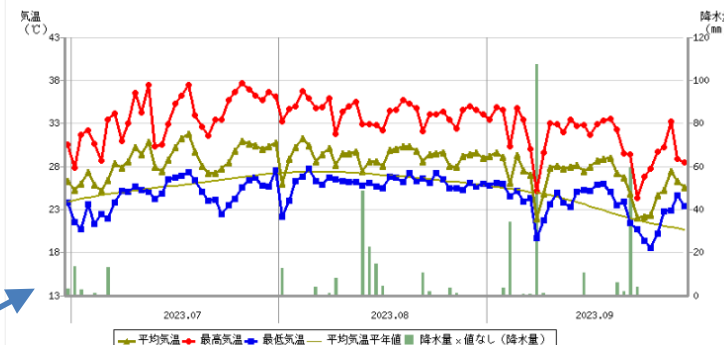
地域区分・地域名: ▼地域区分・地域名を選択してください▼ 国・領域: ▼国を選択してください▼ 地点検索 地点を選択すると「地点別データ・グラフ」のページに移動します。地域区分・地域名に対応する国や領域は [こちらからご確認ください](#)。

2023年07月30日: [日平均気温(℃)]



Tokyo

東京 (トウキョウ) 日本



東京(トウキョウ) - 日本
緯度: 35.69° N / 経度: 139.75° E 高度: 25(m)

ダウンロード -----CSVファイルでダウンロード

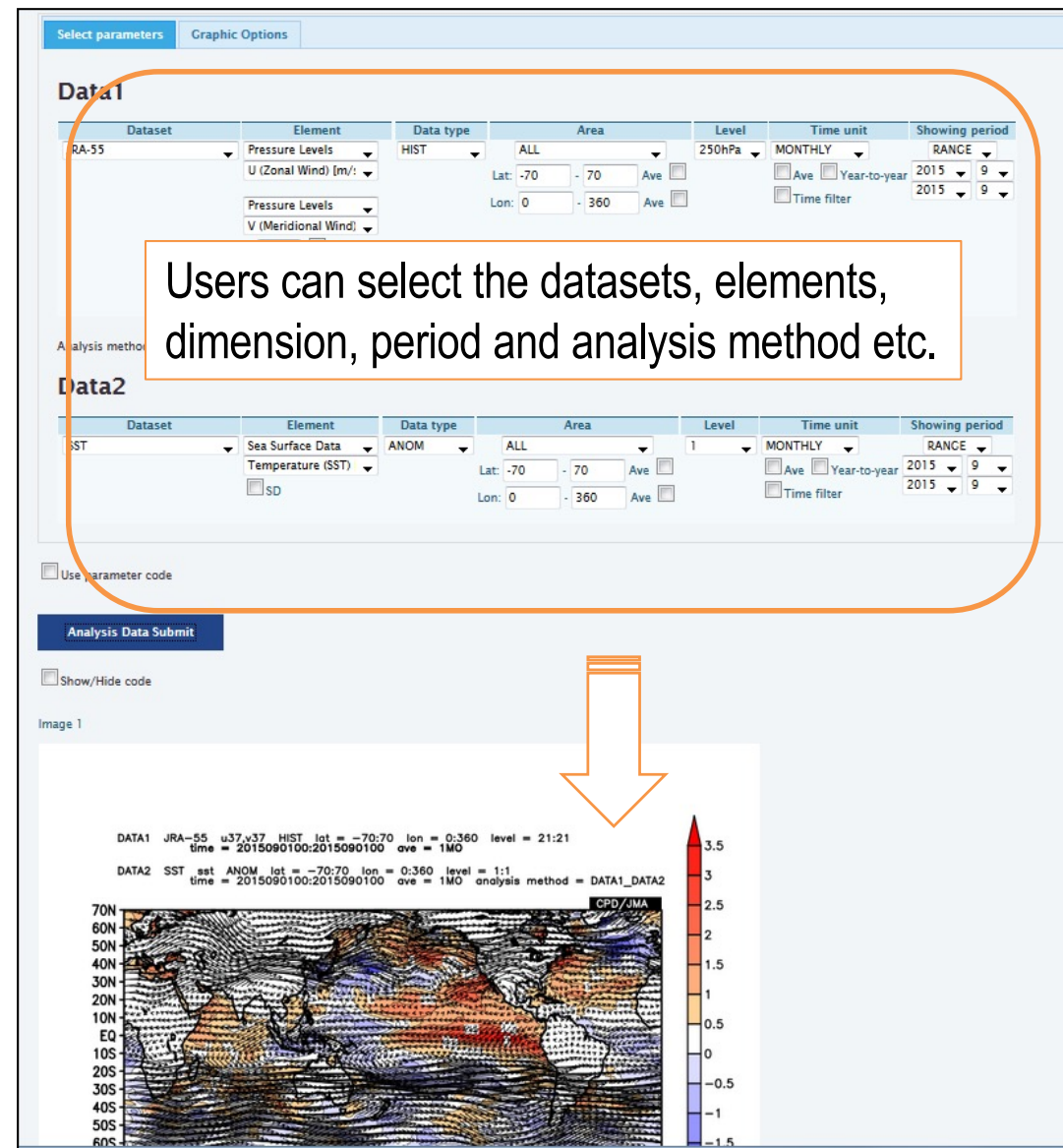
年月日	日別値			
	日平均気温 ℃	日最高気温 ℃	日最低気温 ℃	日降水量 mm
2023年6月30日	26.3	30.5	23.8	3.0
2023年7月1日	25.3	27.8	21.5	13.5
2023年7月2日	26.0	31.7	20.7	2.5
2023年7月3日	27.3	32.2	23.6	—
2023年7月4日	25.9	30.6	21.3	1.0
2023年7月5日	25.2	28.7	22.5	0.0
2023年7月6日	26.4	33.4	22.0	13.0
2023年7月7日	28.4	34.2	23.8	—
2023年7月8日	27.8	30.9	25.2	0.0
2023年7月9日	28.6	33.0	25.1	0.0
2023年7月10日	30.2	36.5	25.7	—
2023年7月11日	29.4	34.3	25.3	—
2023年7月12日	30.8	37.5	26.1	0.0
2023年7月13日	28.0	30.3	24.2	0.0
2023年7月14日	27.4	30.5	24.8	0.0

Time series can be displayed
for 1,2,3 and 5-months

<https://www.data.jma.go.jp/gmd/cpd/monitor/dailyview/index.php>

iTacs: interactive Tool for analysis of the climate system

- The iTacs (Interactive Tool for Analysis of the Climate System) is a web-based application for climatological analysis.
- Based on JRA-3Q
- **The most advantage of iTacs is always to use the updated dataset.**
- The output of analysis can be downloaded in the form of gridded data (GrADS format).
- This tool is available for registered NMHS staffs only.
- Applicants are requested to contact TCC via E-mail.



Outcomes of the capacity development activities

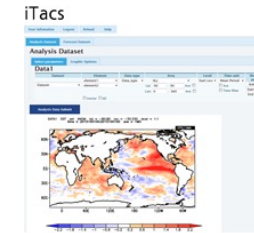
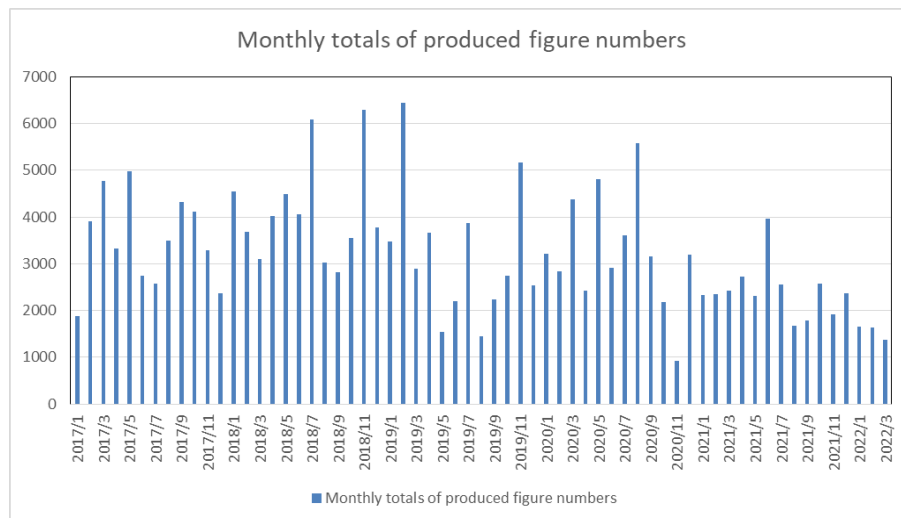
● iTacs in support of generating nationally tailored products

(One of the candidates for Climate Service Toolkit contents)

iTacs, Interactive Tool for Analysis of the Climate System, is a web-based application to assist NMHSs to analyses extreme climate events and to monitor climate status.

Number of monthly use by NMHSs (recent 5yrs)

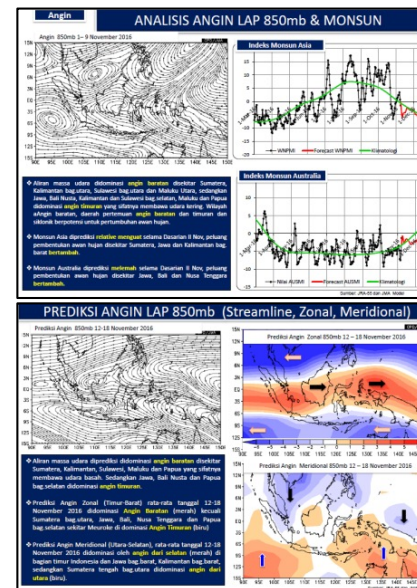
Avg. 3200 figures/1month



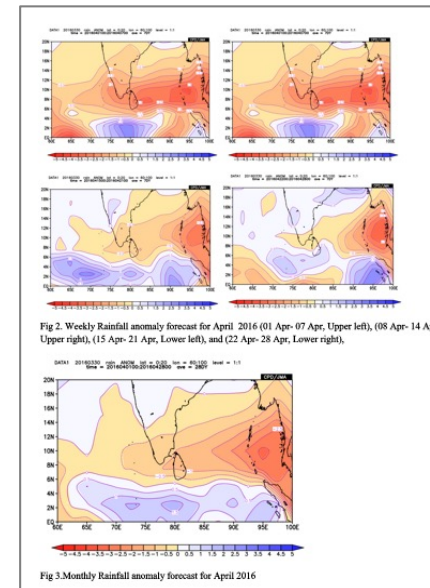
- A case for Indonesia (BMKG) and Sri Lanka (DoM)

The iTacs are used to generate 10-days climate monitoring report in BMKG and one-month forecast products in DoM of Sri Lanka

BMKG

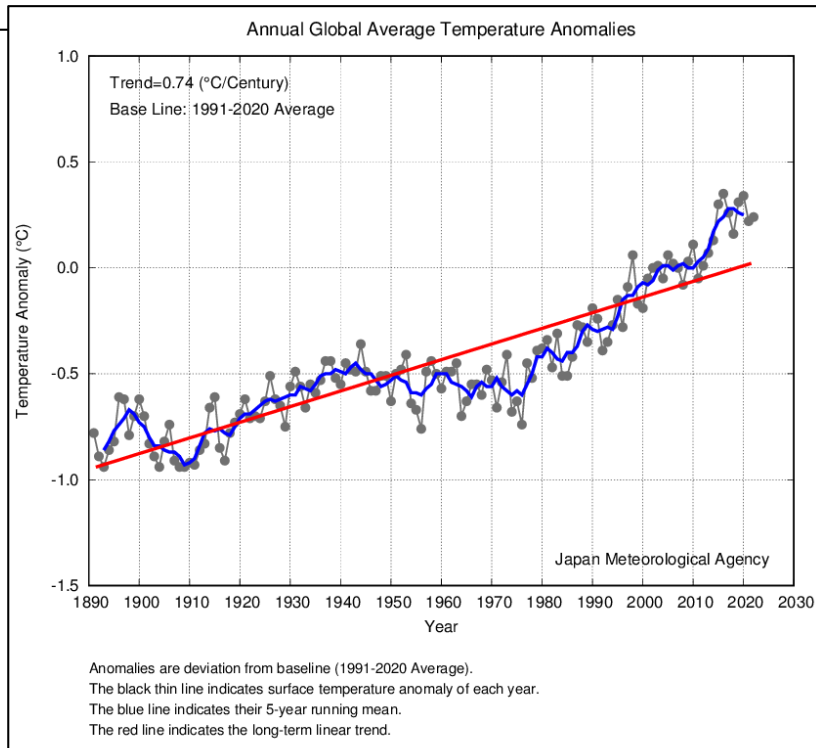


DoM of Sri Lanka



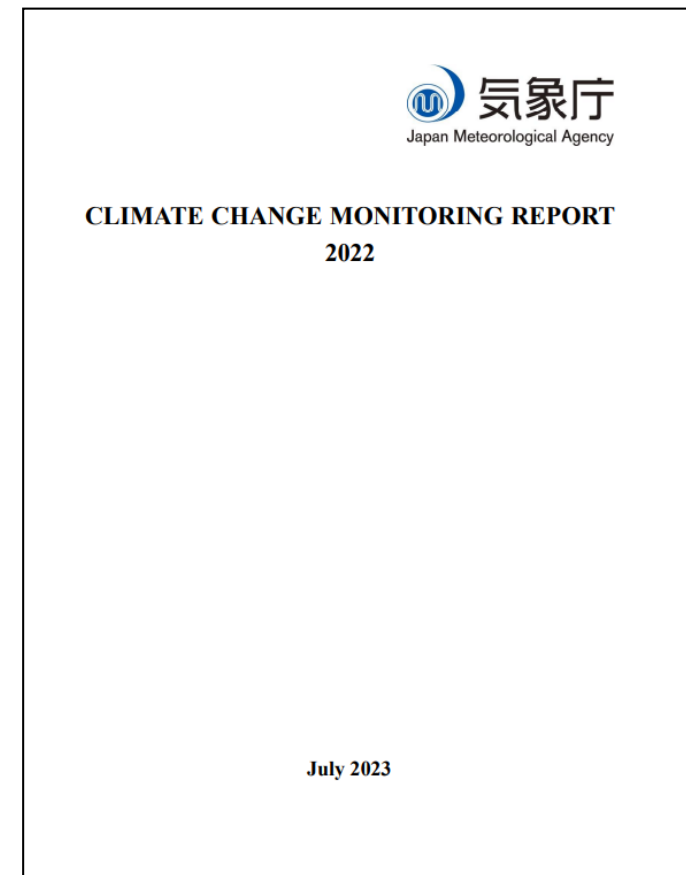
Climate Change monitoring and projection

JMA monitors long-term changes in global average surface temperature anomalies for the purpose of monitoring global warming. The TCC website make it available to see long-term changes in annual and monthly anomalies of the global average surface temperature.



Annual anomalies of surface temperature
averaged over the globe
(Base period for the normal: 1991- 2020)

<https://www.data.jma.go.jp/tcc/tcc/products/gwp/gwp.html>



https://www.jma.go.jp/jma/en/NMHS/indexe_ccmr.html

Climate Risk Management (CRM)

This website includes information on the followings to support CRM activities

- Clarification of the basic CRM concept and related processes
- Good practices in CRM conducted by JMA together with partner organizations in the agriculture, apparel/fashion and drugstore industries

Best practices following areas are available from this page

<http://www.data.jma.go.jp/gmd/risk/en/index.html>

Agricultural sector

To take countermeasures against climate variability by controlling water depth in their rice fields



Apparel industry

- Control of goods in stock
- Arranging a sales plan

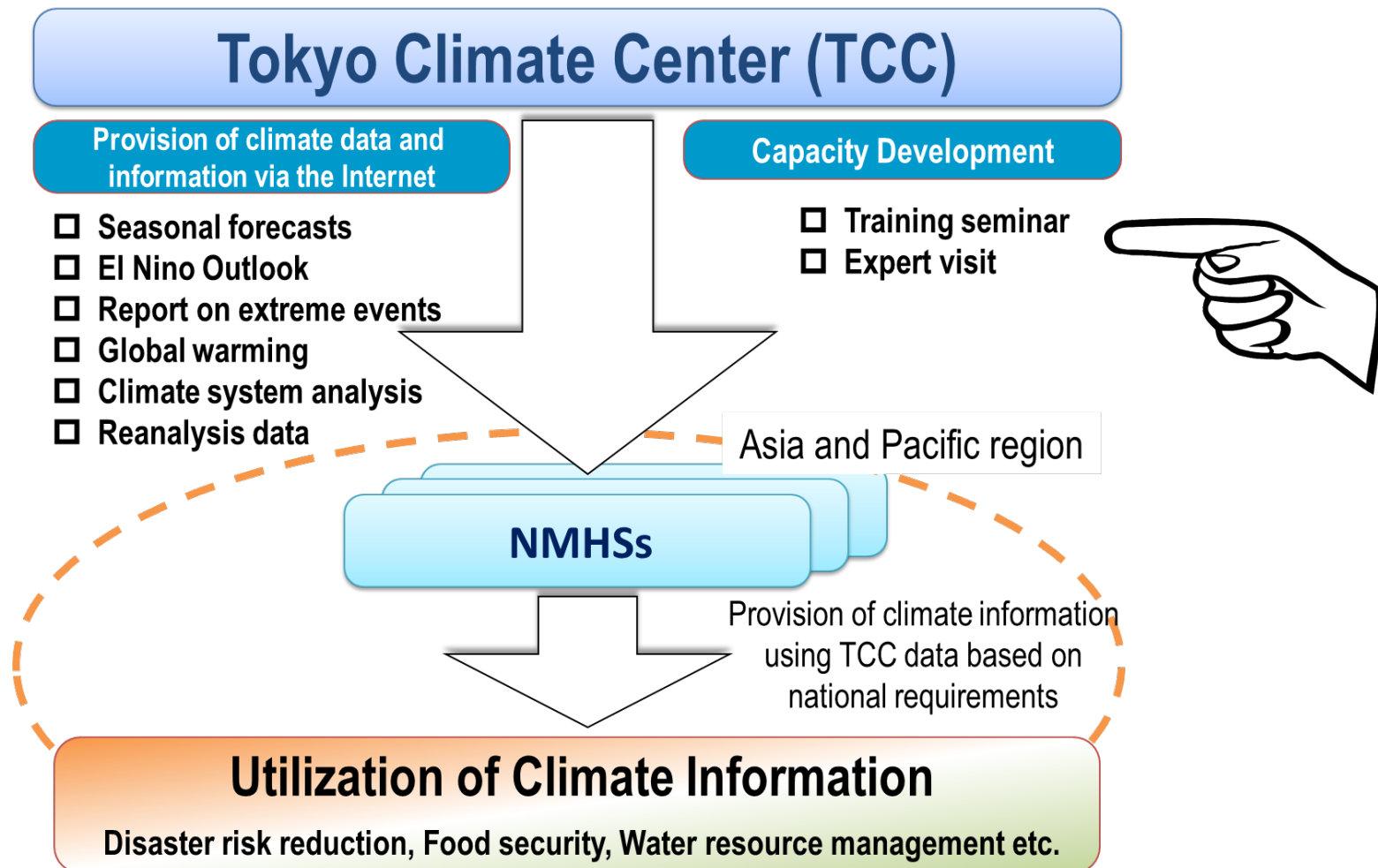


Drugstore company

- Highly affected by temperature

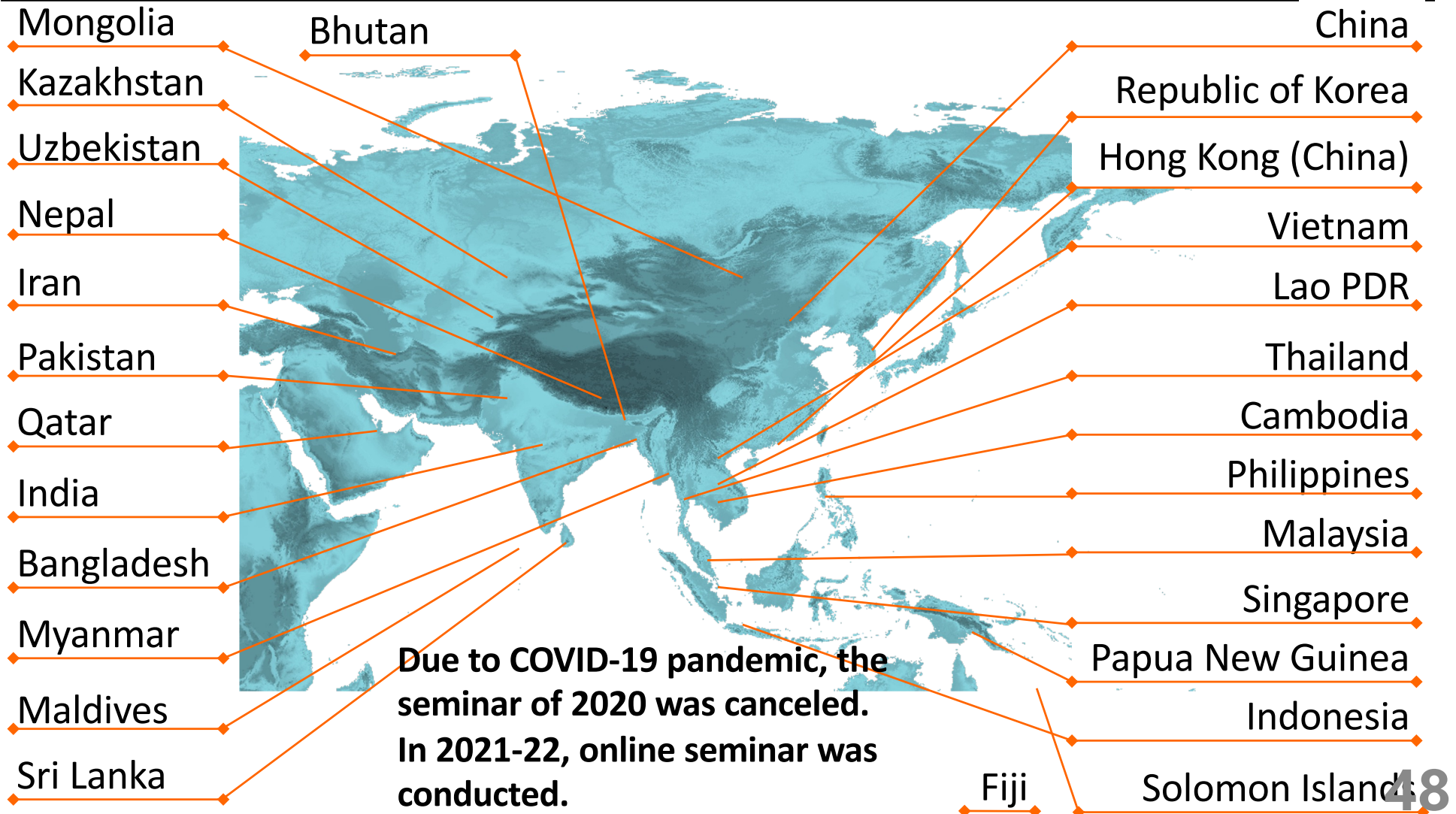
TCC as Regional Climate Center (RCC)

- TCC has served as a WMO Regional Climate Center in the RA II since 2009.
- TCC supports NMHSs through data/information provision and **capacity development activities**.



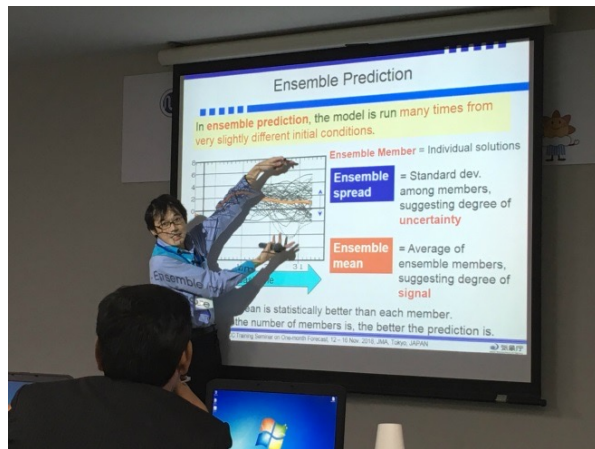
TCC Annual Training Seminar

- As part of TCC's capacity developing activity in its role as RCC, TCC holds annual training seminars on the application of its climate monitoring and prediction products.
- A total of **200 experts** from NMHSs of **27 nations/territories** in Asia-Pacific region have attended since 2008. (as of 2022)

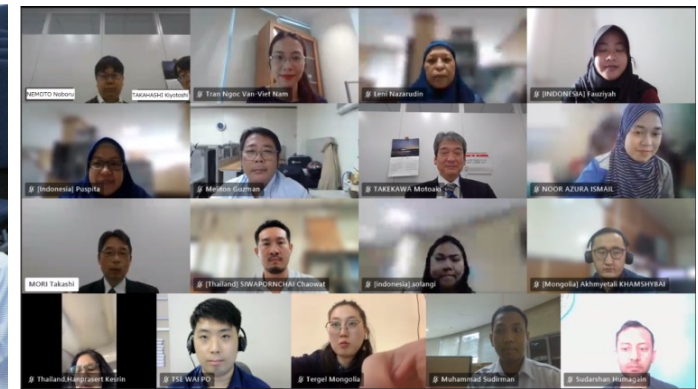


TCC seminar in Nov. 2018 and 2022(online)

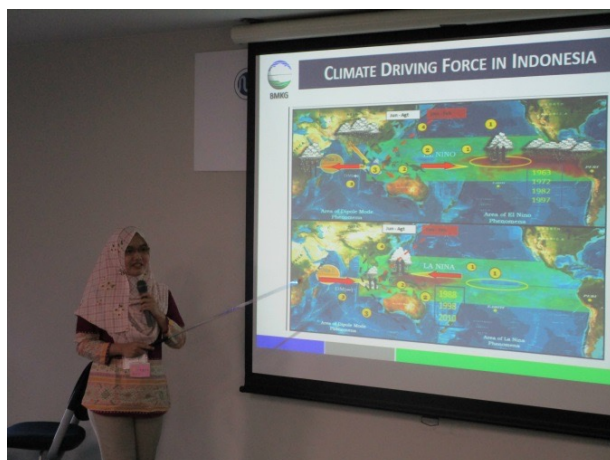
Lectures and exercise sessions



Lectures(online)



Presentation on results of the exercise

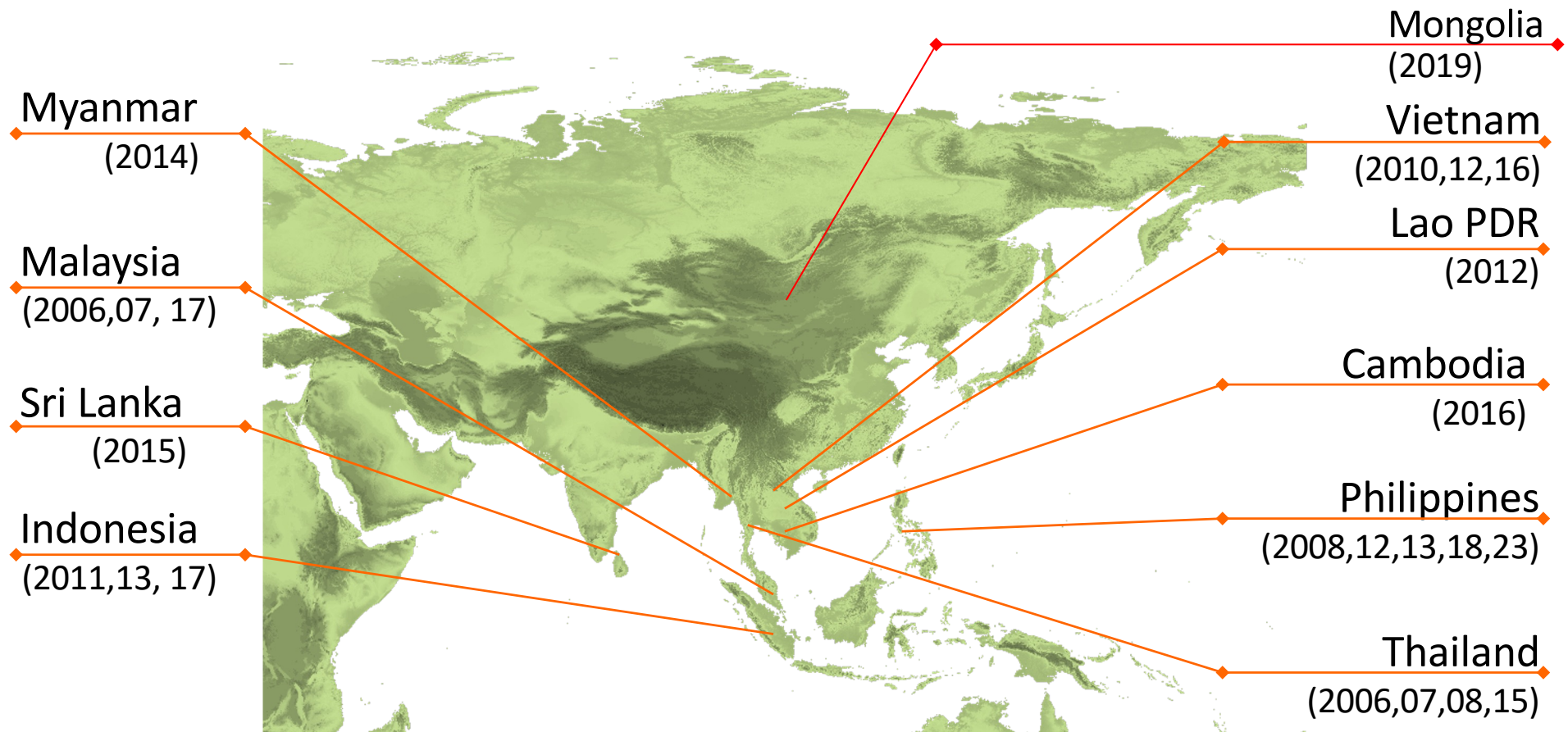


Presentation(online)



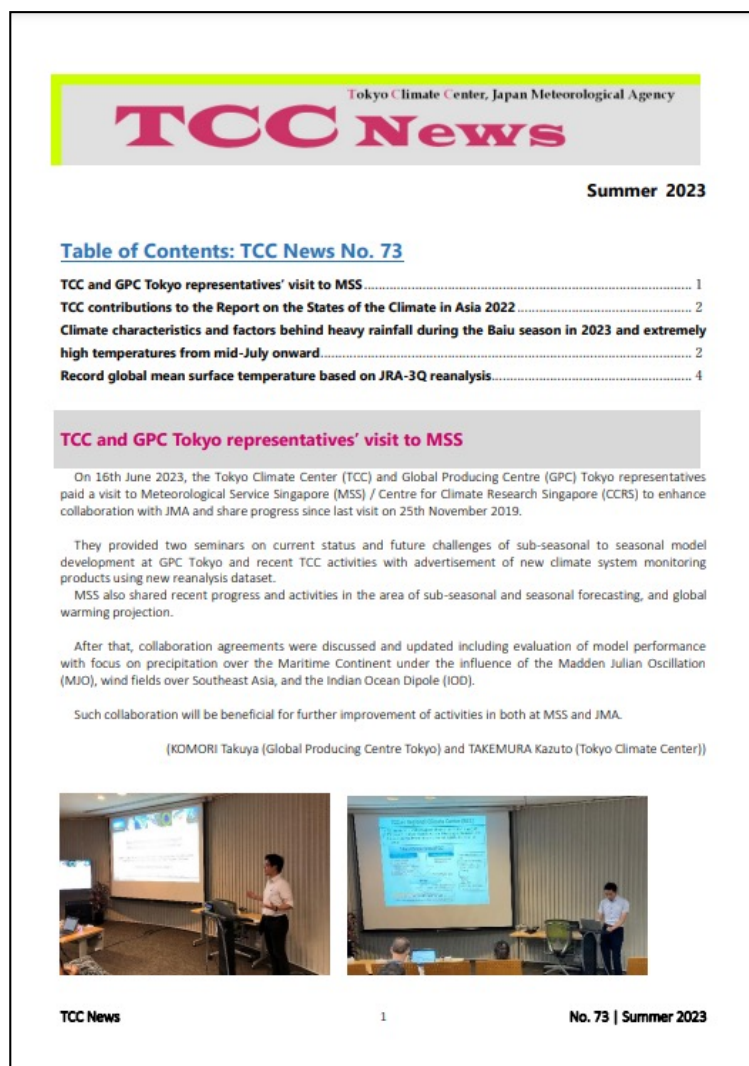
TCC Expert Visit

- TCC has arranged visits by TCC experts to the National Meteorological Services in Asia for discussions, technical cooperation and training seminars since 2006.
- TCC experts visit also aims to share the current challenges of the climate services in each country and to discuss about the request to TCC and future cooperation.



For recent two years, dispatch of experts has been stopped due to COVID-19.

TCC News and Press Releases



- TCC issues a quarterly newsletter **TCC News** in February, May, August, and November containing the following articles;
 - ✓ latest climate information (significant climate events, seasonal outlook)
 - ✓ introduction of TCC's new products
 - ✓ TCC's relevant activity
 - ✓ contribution to the RCOF
 - ✓ participation in the WMO meeting
 - ✓ annual training seminar
 - ✓ visits by TCC experts

<https://www.data.jma.go.jp/tcc/tcc/news/index.html>

TCC's Activities on Information Sharing on Climate Services in WMO RAI



気象庁
Japan Meteorological Agency

Tokyo Climate Center
WMO Regional Climate Center in RA II (Asia)

[TCC home](#) [About T](#)

Home

World Climate

Climate System Monitoring

El Niño Monitoring

NWP Model Prediction

Global Warming

Climate in Japan

Training Module

Press release

HOME

What are WMO RCCs

WMO RCCs are centres of excellence...

RCC Functions

Operational Activities for Long-range Forecasting
Operational Activities for Climate Monitoring

ON 10 NOVEMBER 2017



Monthly mean 500hPa height and anomaly in the Northern Hemisphere (Oct 2017)
The map shows height anomalies (m) at intervals of 50 m. The map includes height anomalies. Anomalies are deviations from the 1981-2010 average.

El Niño Monitoring	Updated: 10 November 2017
Monthly Discussion	Updated: 25 October 2017
Global Warming	Updated: 14 November 2017
Climate in Japan	Updated: 10 November 2017
STRATALERT TOKYO	

Main Products



iTacs
iTacs, Interactive Tool for Analysis of the Climate System, is a web-based application to assist NMHSs to analyse extreme climate events and to monitor climate status.
weather and season prediction products.



El Niño Monitoring
"El Niño Outlook" consists of a diagnosis of current condition and prediction of El Niño/Southern Oscillation. This is issued every month around 10th.



ClimatView
The ClimatView tool enables viewing and downloading of monthly world climate data, including monthly temperature/precipitation statistics and 30-year climate normals.



TCC News
TCC News, a quarterly newsletter from Tokyo Climate Center, acquaints with significant climate disasters and events, forecaster's commentaries on seasonal outlooks, besides topics on the renewal and the usage of TCC products.

What's New

[RSS](#)

26 October 2017 NEW
Announcement: A website for Information Sharing on Climate Services in WMO RA II has been updated.

16 October 2017 NEW
Announcement: The 2016 edition of Climate Change Monitoring Report is now available.

30 August 2017 NEW
Regional Climate Centers

- RA II Regional Climate Center (RCC) Network Homepage
- Beijing Climate Center
- National Climate Centre, Pune **NEW**
- North Eurasian Climate Center (NEACC)
- WMO RA VI RCC-Network

Regional Climate Outlook Forum (RCOF)

- Forum on Regional Climate Monitoring-Assessment-Prediction for Asia (FOCRAII)
- East Asia winter Climate Outlook Forum (EASCOF)
- South Asian Climate Outlook Forum (SASCOF)
- ASEAN Climate Outlook Forum (ASEANCOF)

WMO RA II Climate Services

[Information Sharing on Climate Services **NEW**](#)
Japan Meteorological Agency

- General Information on Climate of Japan
- Monthly Climate Statistics for Japan
- Japanese 55-year Reanalysis (JRA-55)
- Climate Risk Management
- Tokyo Global Information System Centre (GISC Tokyo)
- World Data Center for Greenhouse Gases (WDCGG)



Information Sharing on Climate Services

For the improvement of 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.

Viet Nam

[Home](#) [Members](#) [Links](#) [Contact us](#)

National Centre for Hydro-Meteorological Forecasting (NCHMF)

Last update: March 2014

I. Overall climate information services

- Climate information (data and products) provided operationally for the general public and/or for specific information users
 - Long-range forecasts
 - Analysis and assessment based on historical data
- URL of a portal website providing climate data/products.
 - <http://www.nchmf.gov.vn/> (in Vietnamese)
 - <http://www.nchmf.gov.vn/web/en-US/70/105/Default.aspx> (in English)

II. Long-range forecast

- Long-range forecast services (URL and language(s) used). Relevant forecasts, such as forecast for onset/end of rainy/dry season, drought advisory/warning and agrometeorological forecast, are also considered as services concerned.
 - Monthly predictions - 2 to 4 weeks
 - Ten-day Forecast
 - <http://www.nchmf.gov.vn/web/vi-VN/70/15/Default.aspx> (in Vietnamese)
 - Monthly Forecast
 - <http://www.nchmf.gov.vn/web/vi-VN/70/40/Default.aspx> (in Vietnamese)
 - <http://www.nchmf.gov.vn/web/en-US/70/105/Default.aspx> (in English)
 - Seasonal predictions - 3 to 6 months
 - <http://www.nchmf.gov.vn/web/vi-VN/70/16/Default.aspx> (in Vietnamese)
 - <http://www.nchmf.gov.vn/web/en-US/70/106/Default.aspx> (in English)
- Methods taken by NMHS to generate long-range forecast products (e.g., model and statistical application). (URLs and language(s) used) if relevant information is provided through the Internet.
 - Based on statistical methods
- Use of climate products provided by other NMHSs or meteorological institutes for long-range forecast
 - ECMWF, JMA/TCC, NOAA/CPC, IRI, BoM, APCC, WMO LC

III. Climate Monitoring