

Tokyo Climate Center activities in support of Operational Climate Prediction in Asia-Pacific region

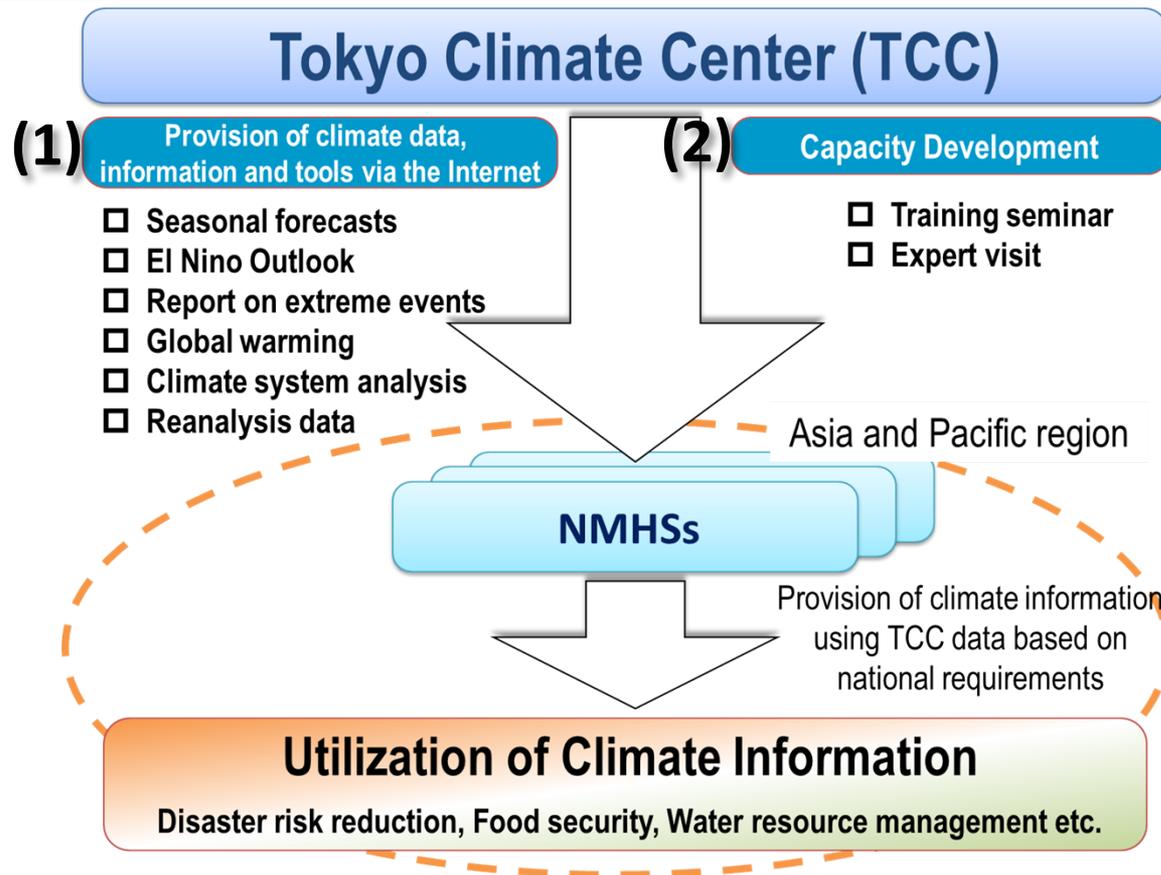
**Tokyo Climate Center (TCC)
Japan Meteorological Agency**

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URL: <https://ds.data.jma.go.jp/tcc/tcc/index.html>**

Tokyo Climate Center (TCC)

- TCC has served as a WMO Regional Climate Center in the RA II since 2009.
- TCC supports NMHSs mainly through the following activities.
 - (1) Provision of data/information/tools on the Internet.** LRF products are provided in close collaboration with GPC Tokyo.
 - (2) Capacity development.**



TCC provides various climate data/products/tools mainly from TCC website



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

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

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

Main Products

[What's New](#) [RSS](#)

What are WMO RCCs

WMO RCCs are centres of excellence...

RCC Functions

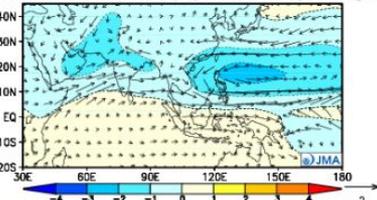
- Operational Activities for Long-range Forecasting
- Operational Activities for Climate Monitoring
- Operational Data Services, to support operational LRF and climate monitoring
- Training in the use of operational RCC products and services

Latest Updates

World Climate	Updated: 13 April 2018
Climate System Monitoring	Updated: 16 April 2018
El Niño Monitoring	Updated: 10 April 2018
Monthly Discussion	Updated: 25 April 2018

Monthly Discussion on Seasonal Climate Outlook No.50 is issued on 25 April 2018.

PSIR850 & wind850 from : 2018/ 4/11 00Z LT=20 days +1.0E6[m**2/s]



Ensemble forecast for stream function and wind vector at 850hPa averaged from May to July 2018

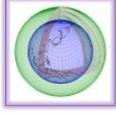
Global Warming	Updated: 16 April 2018
Climate in Japan	Updated: 10 April 2018

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.

GPC Tokyo



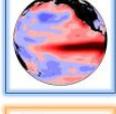
Products of long-range forecast from Global Producing Center (GPC) Tokyo are available. These products are based on JMA's ensemble prediction system.

Monthly Discussion on Seasonal Climate Outlook



This is intended to assist NMHSs in the Asia-Pacific region in interpreting GPC 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.

20 March 2018 NEW

- ▶ [Press release: Characteristics of climate conditions in Japan in winter 2017/18](#)

1 March 2018 NEW

- ▶ [TCC News No. 51 \(Winter 2018: PDF\)](#)
- Global surface temperature for 2017 was the third highest since 1891
- Highlights of the Global Climate in 2017
- Summary of Japan's Climatic Characteristics for 2017
- Cold Spell in Japan from late January 2018
- Cold Waves and Heavy Snow in Japan from December 2017
- TCC Training Seminar on Seasonal Forecast
- TCC Activity Report for 2017

23 February 2018 NEW

- ▶ [Press release: Cold Waves and Heavy Snow in Japan from December 2017](#)

8 February 2018 NEW

- ▶ TCC Training Seminar on Seasonal Forecast (29 January - 2 February 2018)
- [Link to training materials](#)

5 February 2018 NEW

- ▶ [Press release: Cold Spell in Japan from late January 2018](#)

[» Previous news](#)
[» Press release](#)

Links

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 \(FCRPAI\)](#)

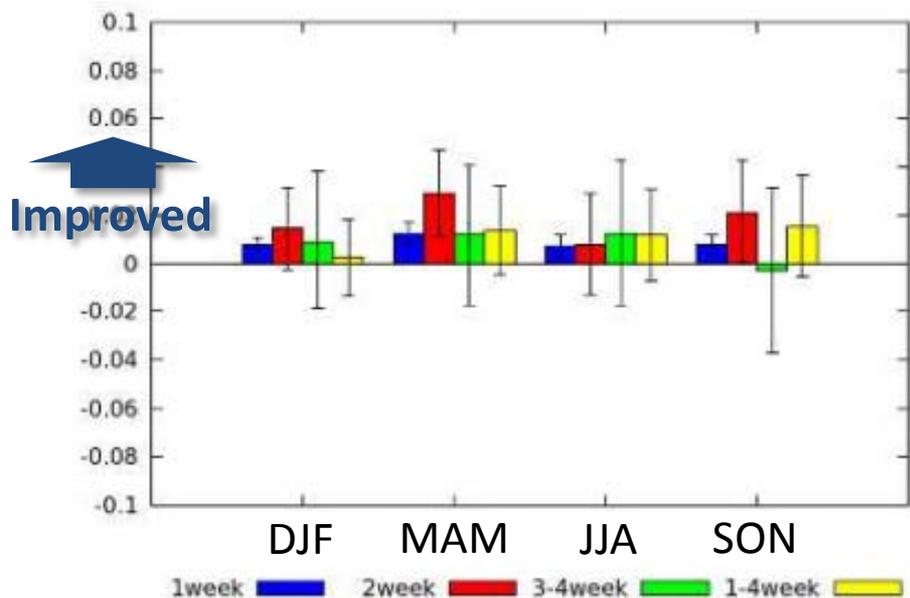
<https://ds.data.jma.go.jp/tcc/tcc/index.html>

JMA's NWP model to make LRF products

	Global EPS for 1-month forecast	Seasonal EPS (JMA/MRI-CSP2)
Last upgrade	March 2017	June 2015
Model	AGCM	Coupled model
AGCM	JMA-GSM Horizontal resolution: TL479 (approx. 40km) (up to 18 days) TL319 (approx. 50km) (after 18 days) Vertical levels: 100 lev. up to 0.01 hPa	JMA-GSM Horizontal resolution: TL159 (approx. 110 km) Vertical levels: 60 lev. up to 0.1 hPa
OGCM	None	MRI.COM Horizontal resolution: 1.0° longitude, 0.3-0.5° latitude Vertical levels: 52 levels and a bottom boundary layer
Ensemble size	50	51
Perturbation method	SV, LETKF, stochastic physics scheme, SST perturbations and LAF	BGM, LAF and stochastic physics scheme
LRF Products	Early warning info., 1-month forecast, etc.	3-month, Warm/Cold season forecast, El Niño Outlook

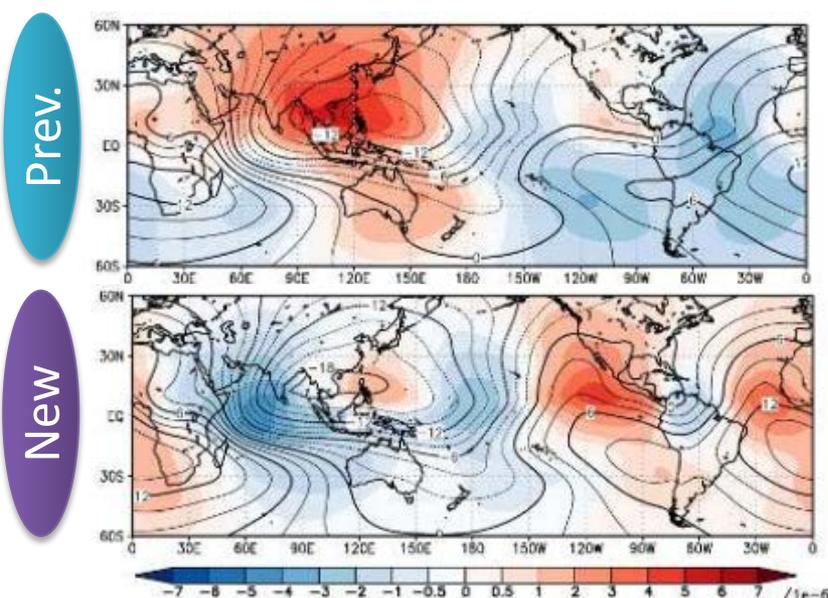
More detailed information: <https://ds.data.jma.go.jp/tcc/tcc/products/model/outline/index.html>

Upgrade of EPS for 1-month forecast



Left : Difference of anomaly correlation coefficients of 500 hPa geopotential height for NH

Right : Bias of velocity potential at 200 hPa (JJA initial for 1-month prediction)



JMA's EPS for 1-month forecast was upgraded in March 2017.

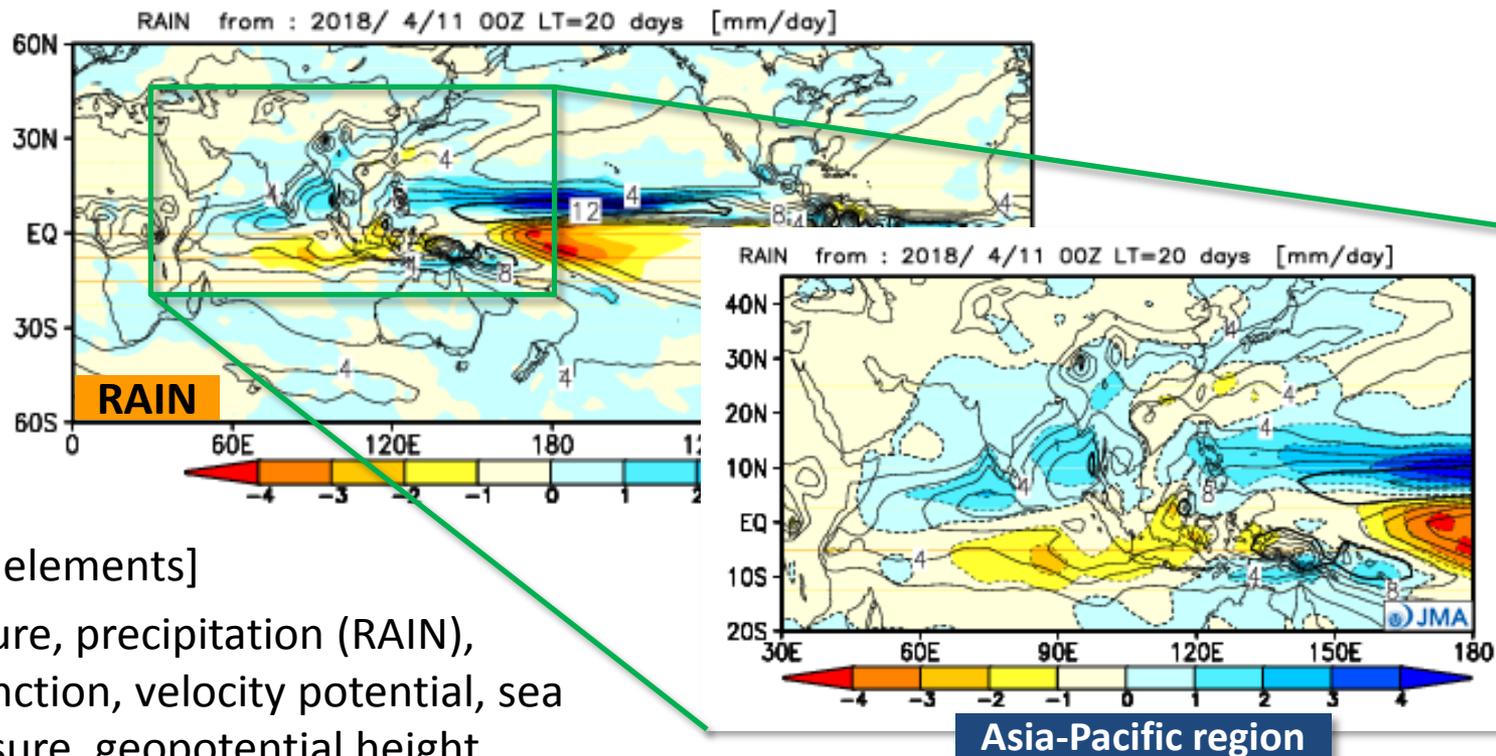
- ✓ Increased horizontal resolution (TL319 (55km) -> TL479 (40km): up to 18days ahead)
- ✓ Increased vertical layers (60 levels (top:0.1hPa) -> 100 levels (top:0.01hPa))
- ✓ Improved physical processes (convection, radiation, sea ice, etc.), and more...

Results of hindcast experiment shows prediction skill enhancement.

- Forecast mean error of the weak Asian summer monsoon has reduced.

LRF maps

Types	Forecast range	Update schedule
1-month forecast	3-9 day, 10-16 day, 17-30 day, 3-30 day	Every Thursday
3-month forecast	1 st month, 2 nd month, 3 rd month, 3-months mean	Every month around 15 th
Warm/Cold season forecast	3-months mean warm season: JJA, cold season: DJF	Around 15 th of a month below Warm season: Feb., Mar., Apr. Cold season: Sep., Oct.



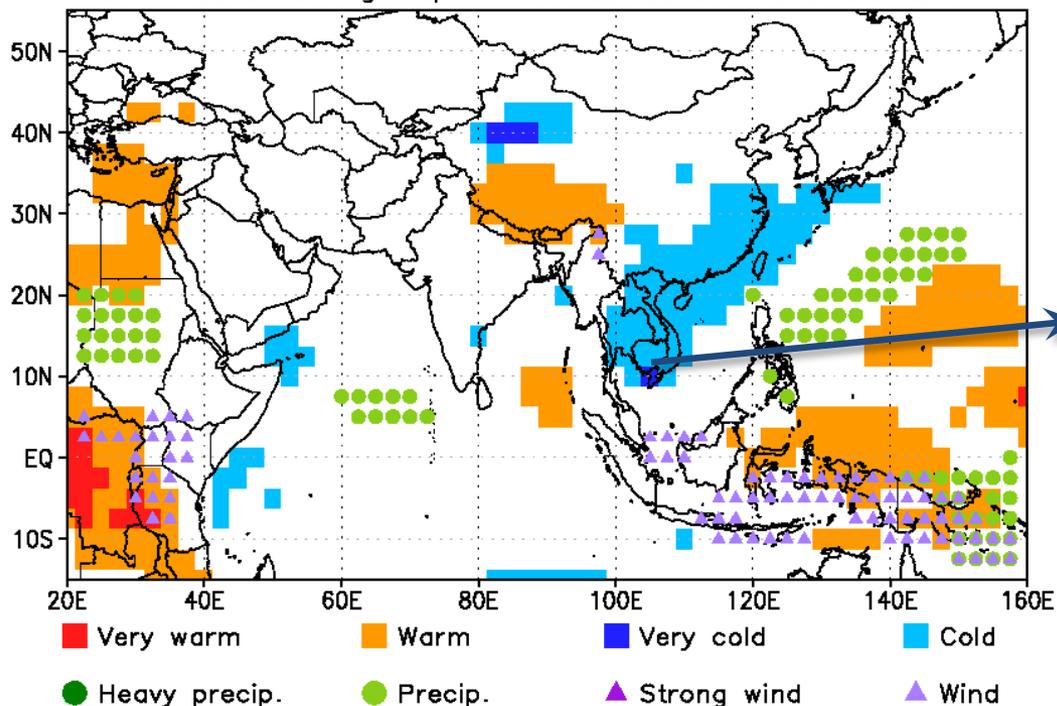
[Available elements]

Temperature, precipitation (RAIN),
stream function, velocity potential, sea
level pressure, geopotential height

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

Forecast Products in support of Early Warnings for Extreme Weather Events

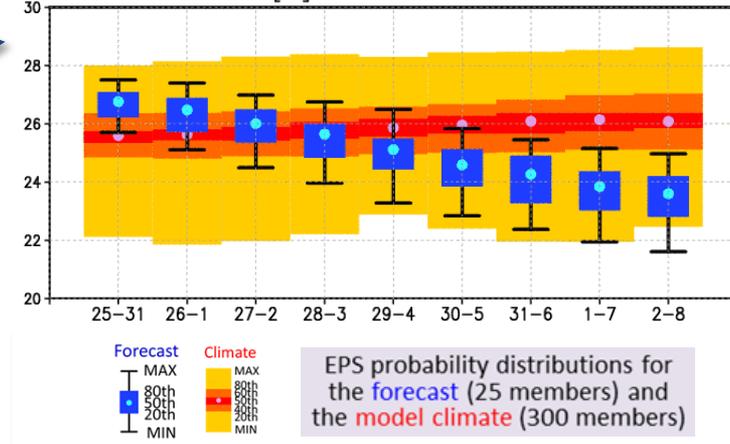
JMA One-month Prediction
EFIR-based warning map init: 20180124 valid: 2:2-2:8



← Early warning map
(2018.1.24 init, +10-16 days average)

↓ Meteogram

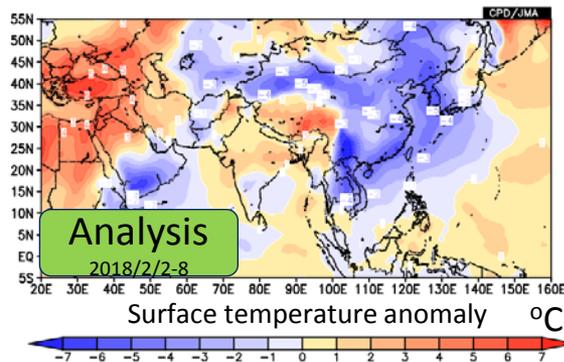
JMA One-month Prediction Meteogram (lon,lat)=(105.0,12.5)
elm: T_SURF init: 20180124 average(day): 7
Forecast and Hindcast [°C]



- This product is issued every Wednesday.
- Early warning maps (3-days or 7-days averaged field) for the next 2 weeks are available.

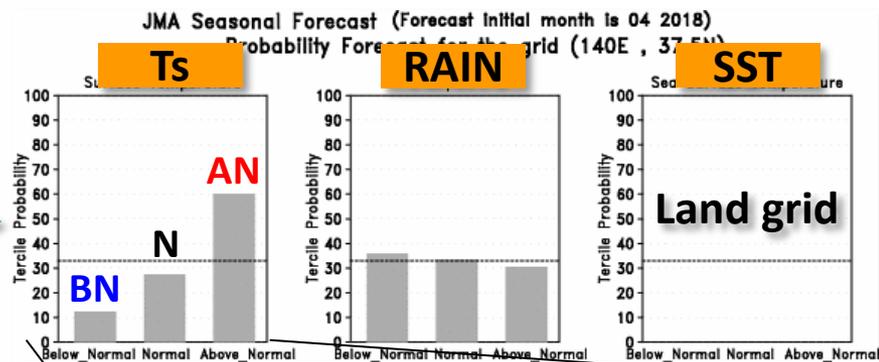
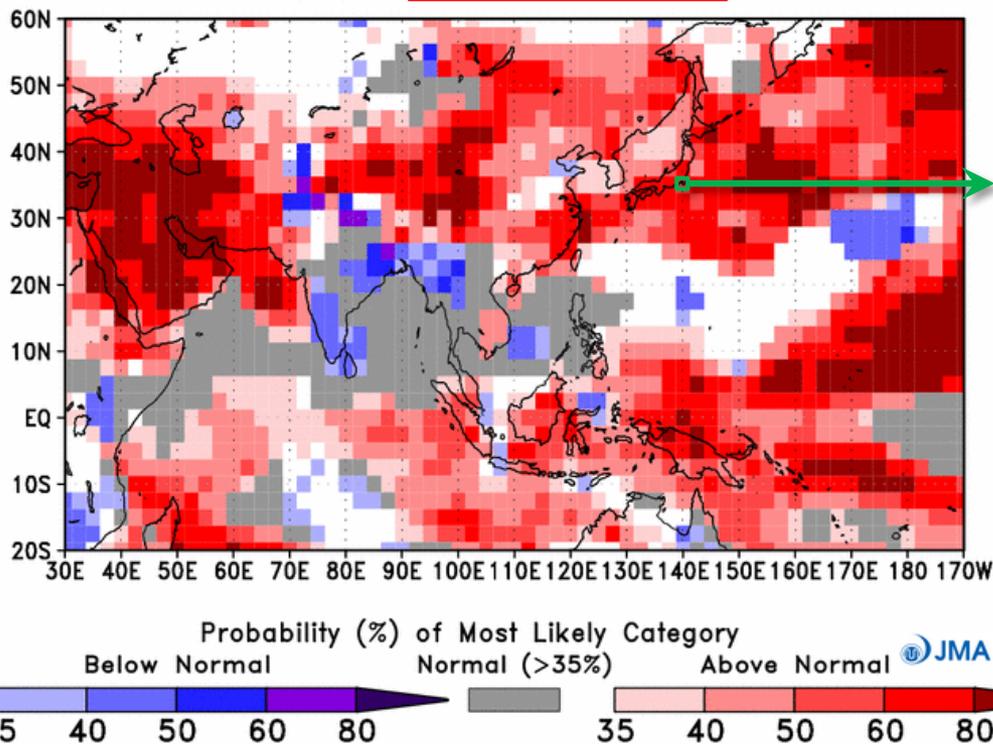
<https://ds.data.jma.go.jp/tcc/tcc/gpv/EFI/index.php> <Password protected>

⊗ This product is for use by NMHSs and does not constitute an official forecast for any nation. 7

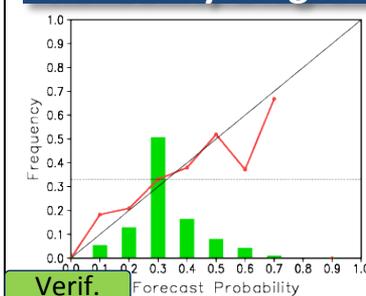


Probabilistic forecast

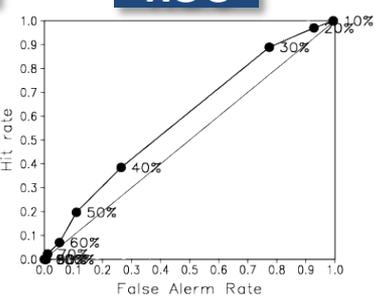
JMA Seasonal Forecast (Forecast initial month is 04 2018)
Most likely category of Surface Temperature for MJJ 2018



Reliability Diagram



ROC



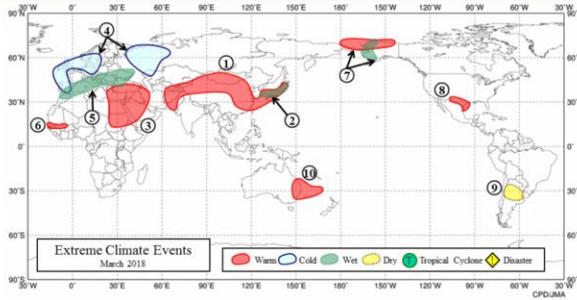
- Tercile probabilistic forecast for 3-month-averaged surface temperature (Ts), precipitation (RAIN) and SST (except for land grids) is provided with their verification information.
- This product is provided along with 3-month or warm/cold season forecast. Dissemination schedule are the same with the table in slide 6.

Monthly Discussion on Seasonal Climate Outlook (1)

This material briefly summarizes the current state of the climate system and its seasonal (3 month, warm/cold season) outlook using TCC's long-range forecast products.

Current state of the climate system

<March 2018> Extreme Climate Events



1. Warm: the eastern part of East Asia to the southeastern part of Central Asia

2. Wet: northern Japan to the south

3. Warm: the northern part of the Middle East

4. Cold: in and around Western Europe

5. Wet: in and around southern Europe

6. Warm: the western part of the Middle East

7. Warm and Wet: in and around the Indian Ocean

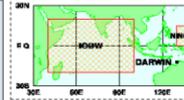
8. Warm: the southern USA

9. Dry: in and around northern Australia

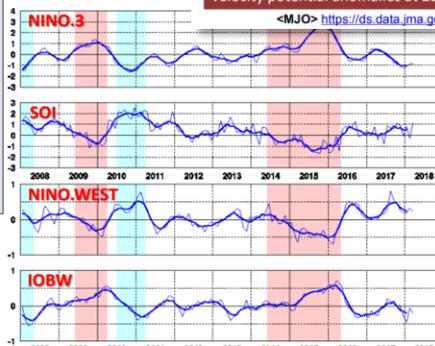
10. Warm: eastern Australia

<March 2018> ENSO Monitor

- It is considered that La Niña conditions continue in the equatorial Pacific.
- The NINO.3 SST was below normal with a deviation of -0.8°C .



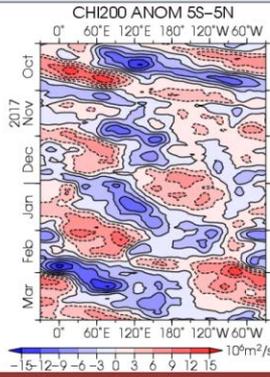
- The Southern Oscillation Index (SOI) value was $+1.2$.
- The area-averaged SST in the tropical western Pacific (NINO.WEST) region was above normal.
- The area-averaged SST in the tropical Indian Ocean (IOBW) region was below normal.



Monthly values (thin lines) and five-month running means (thick lines). The shading indicates El Niño (red) and La Niña (blue) events.
 < El Niño Monitoring and Outlook > <https://ds.data.jma.go.jp/tcc/tcc/products/elniño/monout.html>

<March 2018> Equatorial Intraseasonal Oscillation

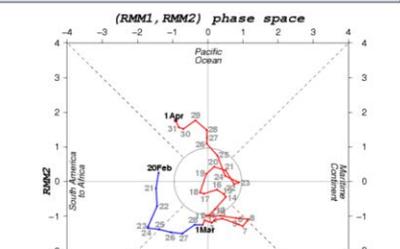
- The active phase of equatorial intraseasonal oscillation propagated eastward in the Indian Ocean in the first half of the month, but the eastward propagation became unclear afterwards.



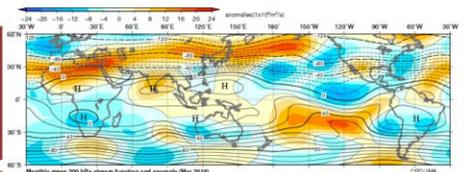
Time-longitude cross section of seven-day run velocity potential anomalies at 200-hPa (5°S - 5°N).
 <MJO> <https://ds.data.jma.go.jp/tcc/tcc/products/mjo/>

<March 2018> Upper-level Circulation

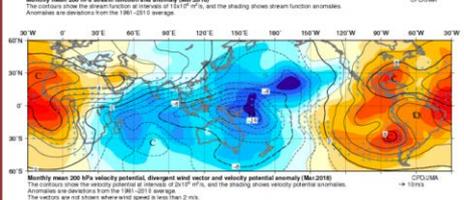
- In the upper troposphere, a wave train was clearly seen from Europe via South Asia to the west of Hawaii with anticyclonic circulation anomalies over the Middle East and to the east of Japan, and cyclonic circulation anomalies over southeastern China and to the west of Hawaii.



Monthly mean Stream function and its anomalies at 200-hPa
 Contour: stream function ($10^6\text{m}^2/\text{s}$)
 Shading: stream function anomalies ($10^6\text{m}^2/\text{s}$)
 "H" and "L" indicate the centers of anti-cyclonic and cyclonic circulations, respectively.



Monthly mean Velocity potential, Divergent wind vector and Velocity potential anomalies at 200-hPa
 Contour: velocity potential ($10^6\text{m}^2/\text{s}$)
 Vector: divergent wind vector (m/s)
 Shading: velocity potential anomalies ($10^6\text{m}^2/\text{s}$)
 "D" and "C" indicate the centers of large-scale divergence and convergence anomalies, respectively.



<Monthly Mean Figures> https://ds.data.jma.go.jp/tcc/tcc/products/clisys/figures/db_hist_mon_tcc.html
 <Animation Maps (Global Area)> https://ds.data.jma.go.jp/tcc/tcc/products/clisys/anim/anim_tp.html

Monthly Discussion on Seasonal Climate Outlook (2)

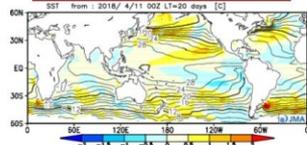
This product is intended to assist operational climate prediction services in Asia-Pacific region. It is issued every month around 25th.

Seasonal Prediction

<MJJ 2018> Sea Surface Temperature (SST)

- It is likely that La Niña conditions will end in boreal spring (90%), and ENSO-neutral conditions are likely during boreal summer (70%).
- It is likely that the NINO.WEST SST will gradually come closer to normal, and will be generally near normal in boreal summer and autumn.
- It is likely that the IOBW SST will be below normal or near normal until boreal autumn.

Three month mean Sea surface temperature (SST)



ENSO forecast probabilities

YEAR/MONTH	mean period	100	90	80	70
FEB	DEC2017-APR2018	100			
MAR	JAN2018-MAY2018	10	90		
APR	FEB2018-JUN2018		60	40	
2018 MAY	MAR2018-JUL2018	10	80	10	
JUN	APR2018-AUG2018	10	80	10	
JUL	MAY2018-SEP2018	10	80	10	
AUG	JUN2018-OCT2018	20	70	10	

Outlook of the SST deviation

■ El Niño ■ ENSO neutral ■ La Niña

<MJJ 2018> Asian Circu

- In the 850-hPa stream function field, cyclonic circulation anomalies are predicted in and around the sea east of the Philippines, and over the northern part of the Arabian Sea.
- In the sea level pressure field, negative anomalies are predicted from the Middle East to the western part of East Asia, and over the western tropical Pacific.
- Above-normal precipitation is predicted in and around South Asia, and southwestern part of East Asia, and from the sea east of the Philippines to the western tropical North Pacific. Below-normal precipitation is predicted over the western equatorial Pacific.

Verification based on hindcast

<https://ds.data.jma.go.jp/tcc/tcc/products/model/hir>
<https://ds.data.jma.go.jp/tcc/tcc/products/model/hir>

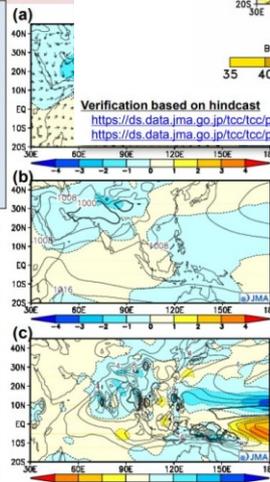
Three month mean

(a) 850-hPa stream function anomalies and wind vector anomalies
 Contour&Shading: 850-hPa stream function anomalies ($10^6 \text{ m}^2/\text{s}$)
 Vector: wind vector anomalies (m/s)

(b) sea level pressure and its anomalies
 Contour: sea level pressure (hPa)
 Shading: sea level pressure anomalies (hPa)

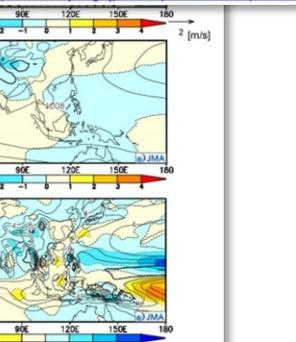
(c) precipitation and its anomalies
 Contour: precipitation (mm/day)
 Shading: precipitation anomalies (mm/day)

Verification based on hindcast <https://ds.data.jma.go.jp/tcc/tcc/products/model/hindcast/CP52/index.html>



Verification based on hindcast

<https://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/>
<https://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/>



Verification based on hindcast <https://ds.data.jma.go.jp/tcc/tcc/products/model/hindcast/CP52/index.html>

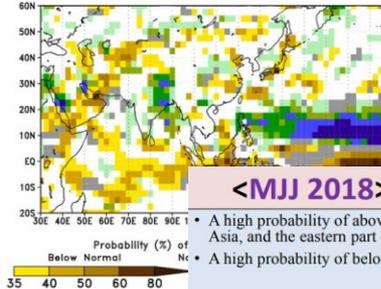
19

<MJJ 2018> Probability Forecasts (precipitation)

- A high probability of above-normal precipitation is predicted from the sea east of the Mariana Islands, and a slightly high probability of above-normal precipitation is predicted in and around the northeastern part of South Asia, and over the sea east of the Philippines.
- A high probability of below-normal precipitation is predicted over the western equatorial Pacific, and a slightly high probability of below-normal precipitation is predicted over the western part of the Maritime Continent.

JMA Seasonal Forecast (Forecast initial month is 04 2018)

Most likely category of Precipitation for MJJ 2018

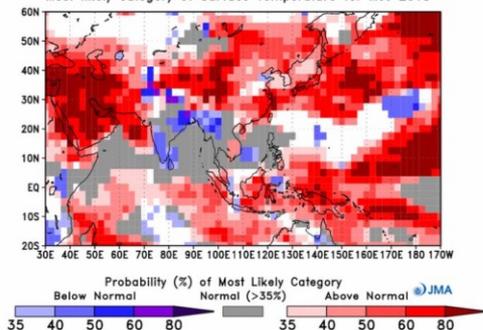


<MJJ 2018> Probability Forecasts (temperature)

- A high probability of above-normal temperatures is predicted over the Middle East, the western part of East Asia, and the eastern part of the Maritime Continent.
- A high probability of below-normal temperatures is predicted over the eastern part of South Asia.

JMA Seasonal Forecast (Forecast initial month is 04 2018)

Most likely category of Surface Temperature for MJJ 2018

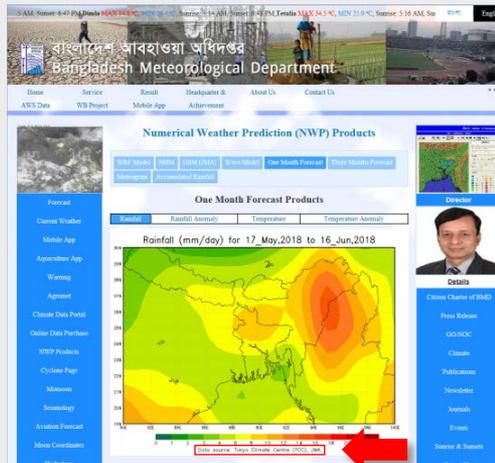


Verification based on hindcast

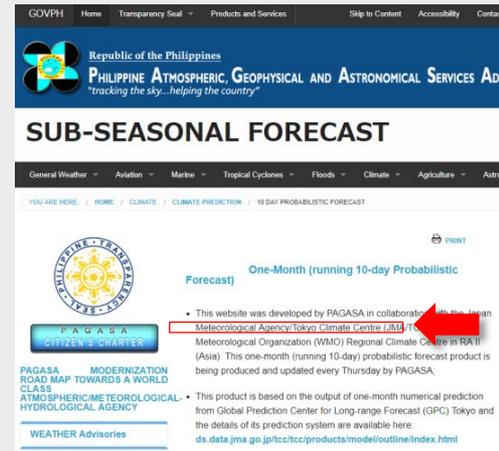
https://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/3-mon/hind/html/skill_reg_3-mon.html
https://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/3-mon/hind/html/skill_2d_3-mon.html

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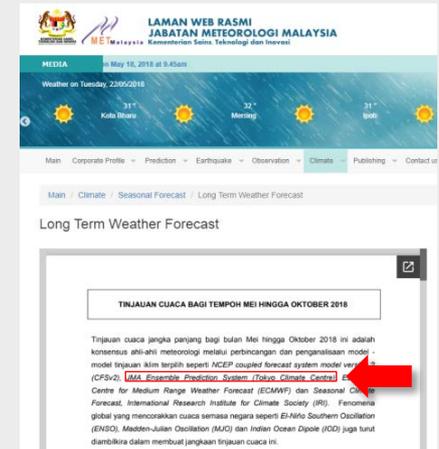
TCC's products are used for Operational Climate Prediction in Asia-Pacific countries



Bangladesh



Philippines



Malaysia

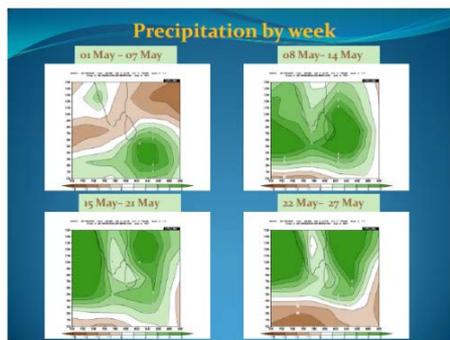
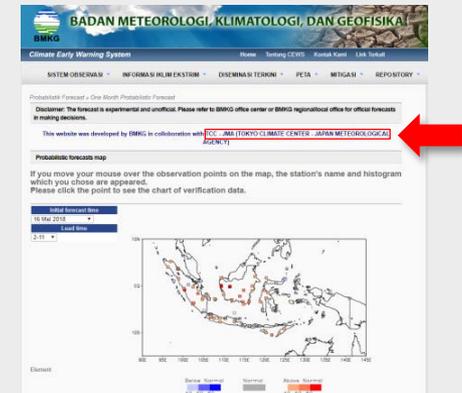


Fig 2. Weekly Rainfall anomaly forecast for May 2018 (01 May - 07 May, Upper left), (08 May - 14 May, Upper right), (15 May - 21 May Lower left) and (22 May - 27 May, Lower right) from JMA model

Sri Lanka



Pakistan

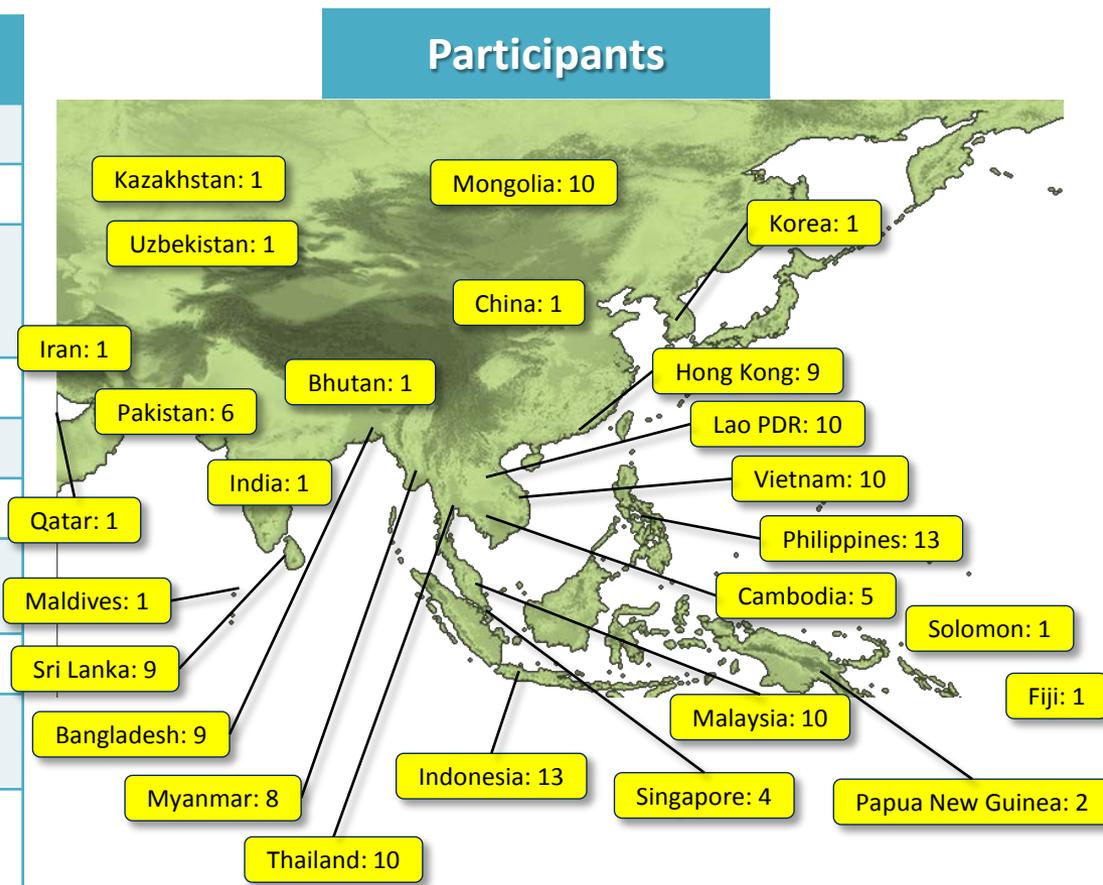


Indonesia

TCC's annual training seminar (1)

- TCC has organized an annual one-week training seminar since 2008 attended by a dozen of invited experts from NMHSs in Asia-Pacific region.
- Each seminar deals with a different theme from climate analysis, **long-range forecast** and global warming projection.

Theme		
1	Nov. 2008	Climate Information and Forecasting
2	Dec. 2009	Climate Analysis using Reanalysis Data
3	Jan. 2011	Application of Seasonal Forecast Gridded Data to Seasonal Forecast Products
4	Nov. 2011	One month Forecast Products
5	Nov. 2012	Climate Analysis Information
6	Nov. 2013	Seasonal Forecast Products
7	Jan. 2015	Global Warming Projection Information
8	Nov. 2015	One-month Forecast
9	Nov. 2016	Primary Modes of Global Climate Variability and Regional Climate
10	Jan. – Feb. 2018	Seasonal Forecast



TCC's annual training seminar (2)

- This seminar comprises a lot of practical exercise sessions with a combination of classroom lectures regarding basic climatology and LRF technique.

Day 1 - Monday, 29 January	
AM	1. Opening 2. Introduction: Outline and scope of the Training Seminar 3. Lecture: "Introduction to Climatology" for experts on climate services
PM	3. Lecture: "Introduction to Climatology" for experts on climate services (cont.) 4. Lecture: Introduction to reanalysis and JRA-55 5. Exercise: Introduction and operation of iTacs (Basic)
Day 2 - Tuesday, 30 January	
AM	6. Lecture: Seasonal Forecast 7. Lecture: Variability in the tropical oceans and its impact to the climate 8. Lecture: JMA's Ensemble Prediction System (EPS) for seasonal Forecasting
PM	9. Exercise: Introduction and operation of iTacs (Advanced) 10. Lecture: Introduction of seasonal forecast guidance
Day 3 - Wednesday, 31 January	
AM	11. Exercise: Seasonal Forecast
PM	11. Exercise: Seasonal Forecast (cont.) 12. Lecture: Interpretation of guidance, verification result and outputs from NWP
Day 4 - Thursday, 1 February	
AM	13. Exercise: Generating seasonal forecast for your country
PM	13. Exercise: Generating seasonal forecast for your country (cont.) 14. Presentation by participants
Day 5 - Friday, 2 February	
AM	14. Presentation by participants (cont.) 15. Wrap up

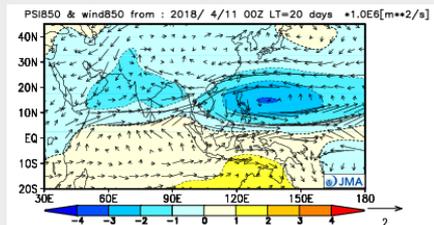
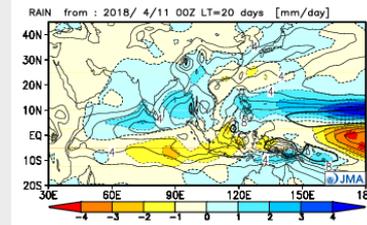
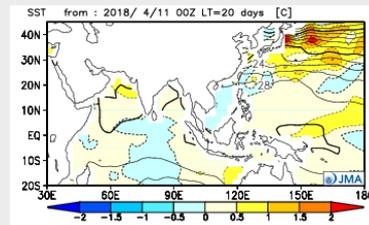
Exercise sessions

Schedule of the TCC Training Seminar on Seasonal Forecast (29 January - 2 February 2018)

TCC's annual training seminar (3)

- For example, in exercise sessions of a seminar on LRF, participants practice making LRF for their own countries using data, information and tools available on the TCC website and learn the following procedure to make LRF.

- I. Understand the current climatic conditions (the state of ocean and atmosphere)
- II. Check NWP outputs (ENSO, convections and associated atmospheric circulation, etc.)



- III. Check their prediction skill and evaluate the reliability focusing on the factors affecting climate condition of the region of interest
- IV. Check the guidance to estimate forecast probabilities
- V. Modify the guidance based on step III, guidance skill and the past statistical information, etc., and finalize LRF for the region of interest.

Guidance		
BN	N	AN
11%	27%	62%



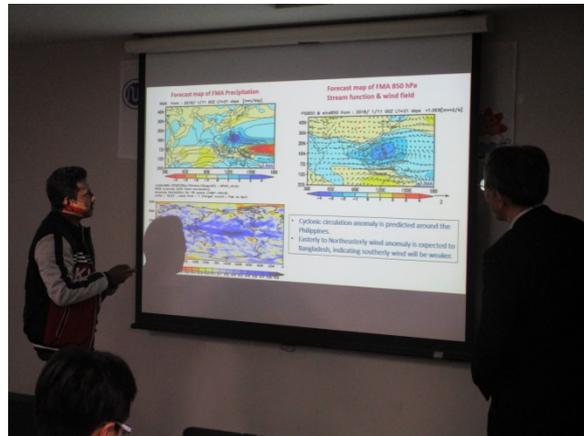
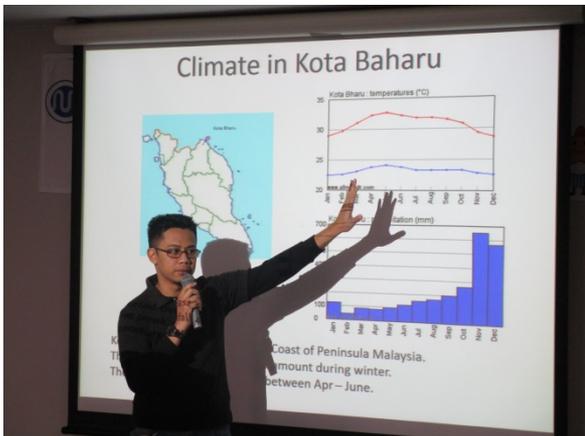
Modified		
BN	N	AN
20%	30%	50%

TCC's annual training seminar (4)

Lecture and Exercise session



Presentation on results of exercises





Thank you for your kind attention!

