



JMA's seasonal forecast system and its application

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On behalf of
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2. Application products

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1. JMA's seasonal forecast system

Organization of the Climate Prediction Division

JMA Headquarters

Global Environment and Marine Department

Administration Division

Climate Prediction Division

Marine Division

Atmospheric Environment Division

Administration Department

Forecast Department

Observations Department

Seismological and Volcanological Department

Director

Deputy-Director

Forecast Unit

Global Climate Monitoring Unit

Global Warming Unit

Climate System Monitoring Unit

**Numerical Weather Prediction and
Re-analysis Unit**

El Niño Unit

Tokyo Climate Center (TCC) No. of staff: 5

Total number of staff members: 50



1. JMA's seasonal forecast system

Type of seasonal forecasts

At present we use three models for seasonal prediction.

- **One-month Forecast**
- Early Warning Information on Extreme Weather (within two-weeks) **New Info (March 2008~)**

- **Three-month Forecast**
- **Warm/Cold seasonal Forecast**

Unified

- **El- Niño Outlook**



1. JMA's seasonal forecast system

Outline of EPS systems

One-month Forecast

- TL159: 1.125deg
- L60: top=0.1hPa
- **Ensemble size: 50**
- I. Perturbation: **BGM/LAF**
- Frequency: **Once a week**
- Forecast period: **34 days**
- Land: SiB
- SST: **Persisted anomaly**

Early Warning

- Forecast period: **17 days**

Seasonal Forecast

- TL95: 1.875deg
- L40: top=0.4hPa
- **Ensemble size: 51**
- I. Perturbation: **SV**
- Frequency: **Once a month**
- Forecast period: **120/210 days**
- Land: SiB
- **SST: Prescribed using persisted anomaly, climatology and ENSO prediction by CGCM**

El Niño Outlook

Atmosphere

- TL95: 1.875deg
- L40: top=0.4hPa

Ocean

- 1° (lon) x 1° (lat), (1° (lon) x 0.3° (lat) near equator)
50 vertical levels
- **Ensemble size: 12**
- I. Perturbation: **LAF (5 days interval)**
- Frequency: **once a month**
- Forecast period: **15 months**
- Land: SiB



1. JMA's seasonal forecast system

Outline of Verification

Standard Verification System for Long Range Forecast (SVSLRF)

- WMO standard tool to verify skill in seasonal models
- Two kind of verification
 - 1) Deterministic : MSSS
 - 2) Probabilistic : ROC, Reliability diagram (BSS)
- Verification data recommended
 - T2m(Surface 2m temp.) : CRU or ERA-40
 - Precipitation : GPCP

If recommended data is not available, the center can use the center own reanalysis. → **JRA-25 in the case of JMA**



2. Application products

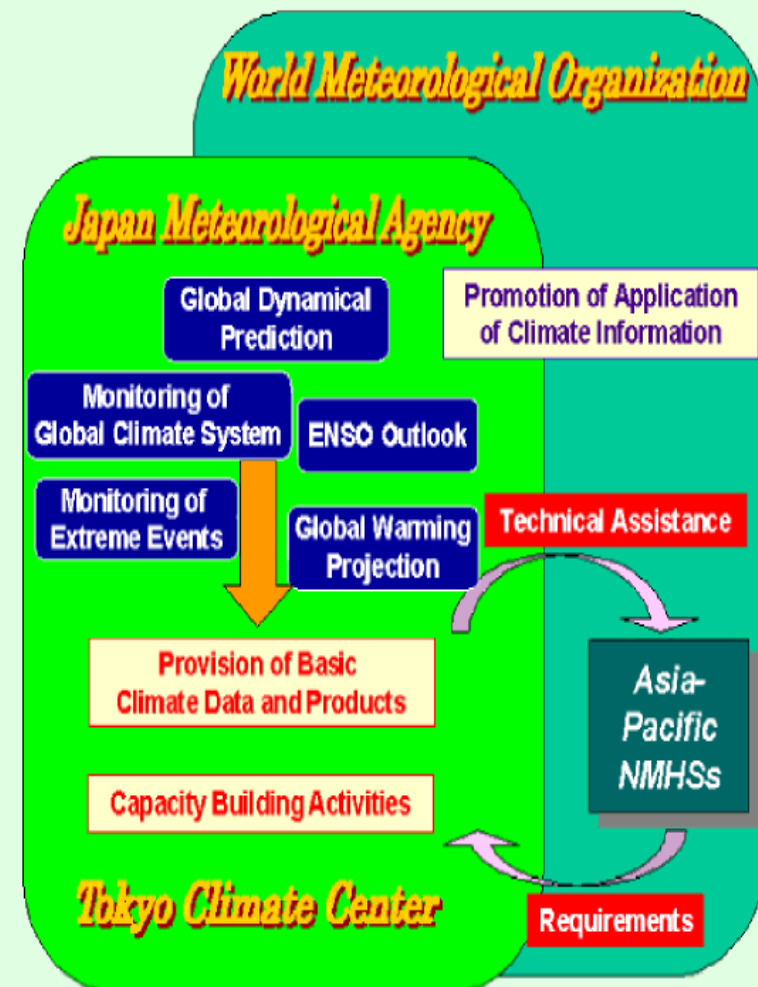
2.-1. Introduction of TCC

Tokyo Climate Center (TCC) was established in April 2002.

Mission :

- To assist Climate Services of NHMSs in the Asia-Pacific region
- With the aim of mitigating climate-related disasters and contributing to the sustainable development in the region

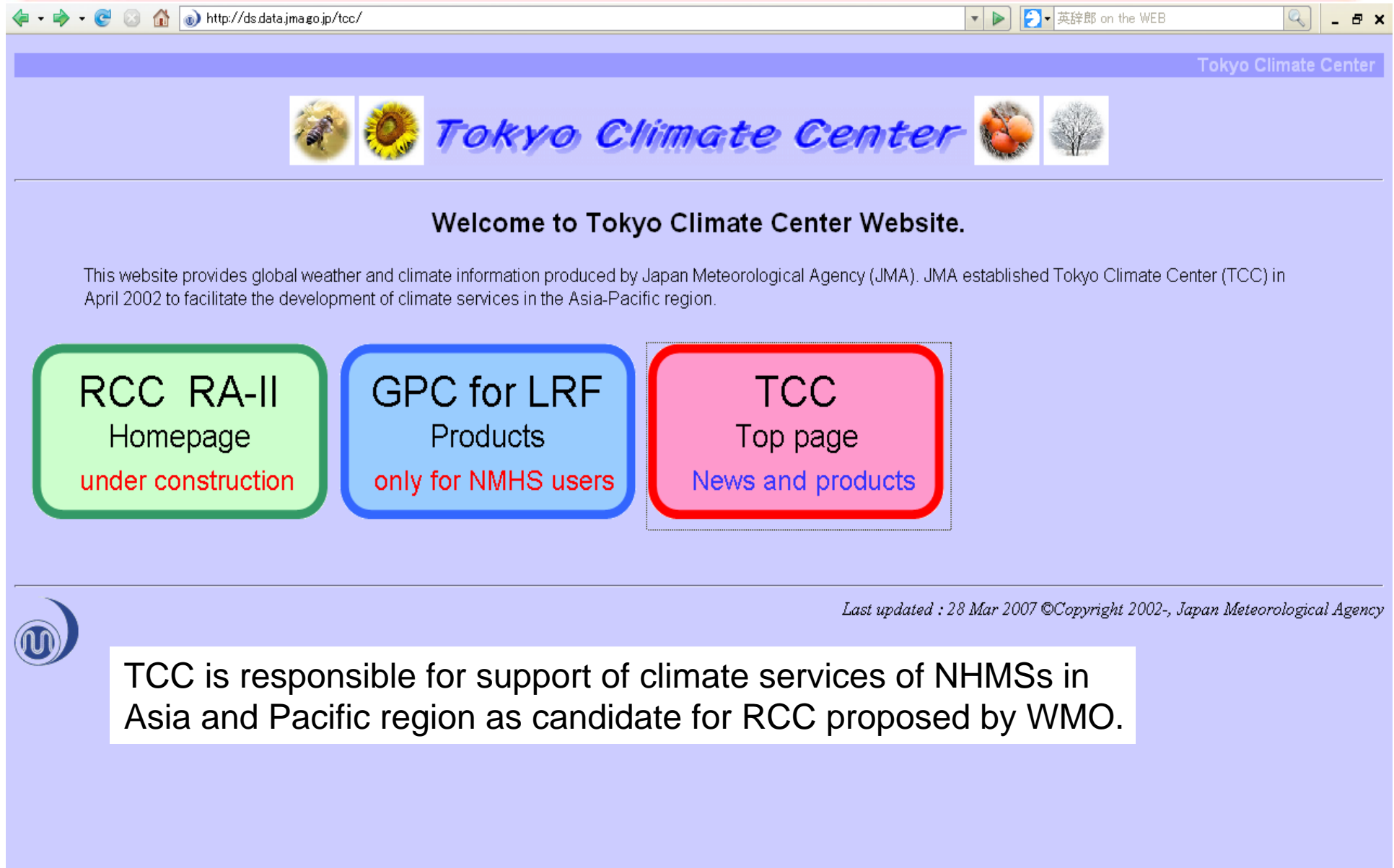
TCC provides NHMSs data and information as follows,
Climate monitoring,
Seasonal forecasts,
El Niño monitoring and outlook,
Global warming,
other related information,
and supports capacity building through seminars or training courses.





2.-1. Introduction to TCC

TCC Web page (<http://ds.data.jma.go.jp/tcc/>)



The screenshot shows a web browser window displaying the Tokyo Climate Center website. The browser's address bar shows the URL <http://ds.data.jma.go.jp/tcc/>. The website header features the text "Tokyo Climate Center" in a blue font, accompanied by several small images: a bee, a sunflower, a cluster of oranges, and a tree. Below the header, a welcome message reads "Welcome to Tokyo Climate Center Website." followed by a paragraph: "This website provides global weather and climate information produced by Japan Meteorological Agency (JMA). JMA established Tokyo Climate Center (TCC) in April 2002 to facilitate the development of climate services in the Asia-Pacific region." Three main navigation buttons are displayed: a green button for "RCC RA-II Homepage" (under construction), a blue button for "GPC for LRF Products" (only for NMHS users), and a red button for "TCC Top page" (News and products). At the bottom left is a small logo, and at the bottom right is the text "Last updated : 28 Mar 2007 ©Copyright 2002-, Japan Meteorological Agency".

Tokyo Climate Center

Tokyo Climate Center


Welcome to Tokyo Climate Center Website.

This website provides global weather and climate information produced by Japan Meteorological Agency (JMA). JMA established Tokyo Climate Center (TCC) in April 2002 to facilitate the development of climate services in the Asia-Pacific region.

RCC RA-II
Homepage
under construction

GPC for LRF
Products
only for NMHS users

TCC
Top page
News and products



Last updated : 28 Mar 2007 ©Copyright 2002-, Japan Meteorological Agency

TCC is responsible for support of climate services of NHMSs in Asia and Pacific region as candidate for RCC proposed by WMO.



2.-1. Introduction to TCC

TCC Web page (<http://ds.data.jma.go.jp/tcc/tcc/index.html>)

The screenshot shows the Tokyo Climate Center website interface. At the top, there is a navigation bar with the following menu items: Home, Climate in the World, Climate System Monitoring, El Niño Monitoring, NWP Model Prediction, Global Warming, Climate in Japan, Training Module, and News. Below the navigation bar, the main content area is divided into several sections. On the left, there is a 'Main Page' section with links to 'NWP Model Prediction', 'Global Warming', and 'Climate and Outlook in Japan'. In the center, there is a 'What's New' section with a date of '10 July 2008' and a 'NEW' tag. On the right, there is a 'Links' section with various external links. The callout boxes highlight the following features:

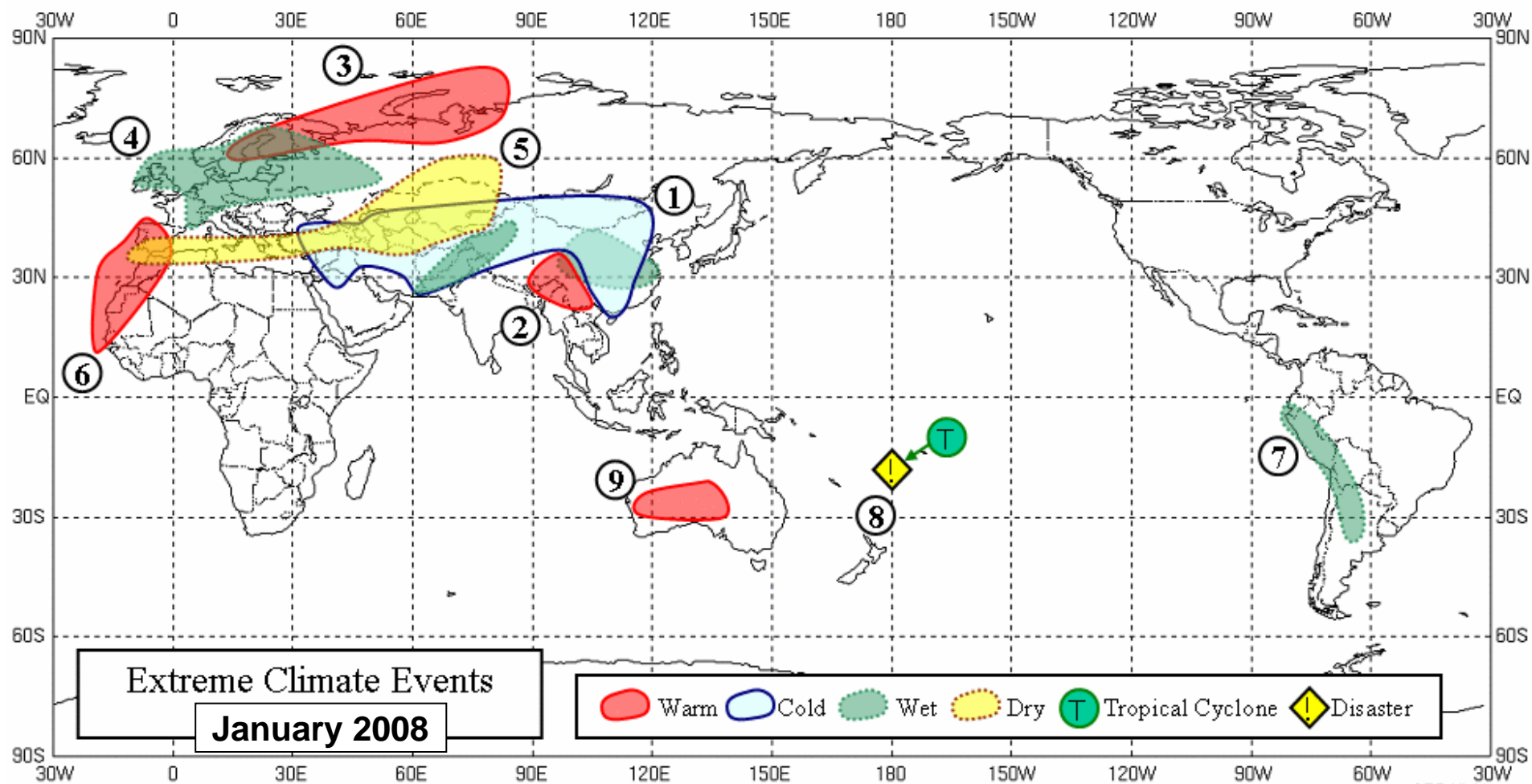
- Climate in the world**: A pink callout box pointing to the 'Climate in the World' menu item.
- El Niño Monitoring**: A pink callout box pointing to the 'El Niño Monitoring' menu item.
- Global Warming**: A pink callout box pointing to the 'Global Warming' menu item.
- Climate System Monitoring**: A pink callout box pointing to the 'Climate System Monitoring' menu item.
- NWP Model Prediction**: A pink callout box pointing to the 'NWP Model Prediction' menu item.
- Climate in Japan**: A pink callout box pointing to the 'Climate in Japan' menu item.
- Training Module**: A pink callout box pointing to the 'Training Module' menu item.
- ClimateView**: A yellow callout box pointing to the 'ClimateView' section, which includes a world map and a link to 'Download Long-range forecast (LRF) Products for GPC'.
- GPC**: A yellow callout box pointing to the 'GPC LRF products' section, which includes a GPC logo and a link to 'Download Long-range forecast (LRF) Products for GPC'.
- Monthly Highlights on Climate System**: A yellow callout box pointing to the 'Monthly Highlights on Climate System (latest issue)' section, which includes a link to 'Monthly Highlights on Climate System'.



2.-1. Introduction to TCC

TCC Web page (**Climate in the world**)

Weekly, Monthly, Seasonal and Annual Temperature/Precipitation
Hazardous Climatic Events (Flood / Drought / Tropical Cyclone)

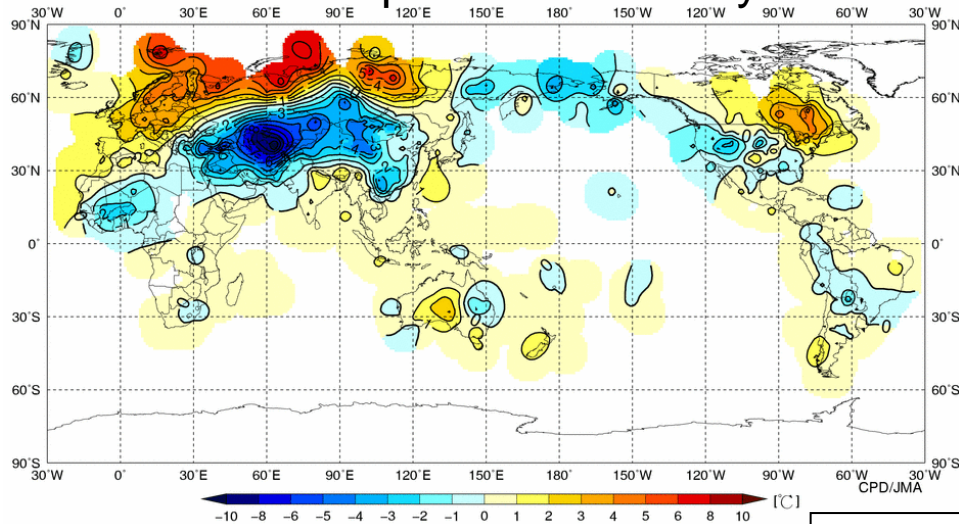




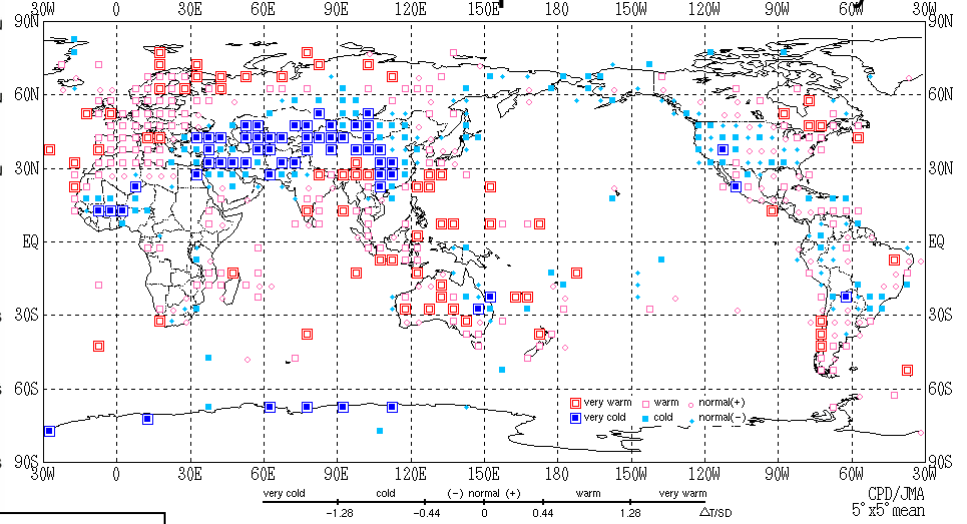
2.-1. Introduction to TCC

TCC Web page (**C**limate in the world)

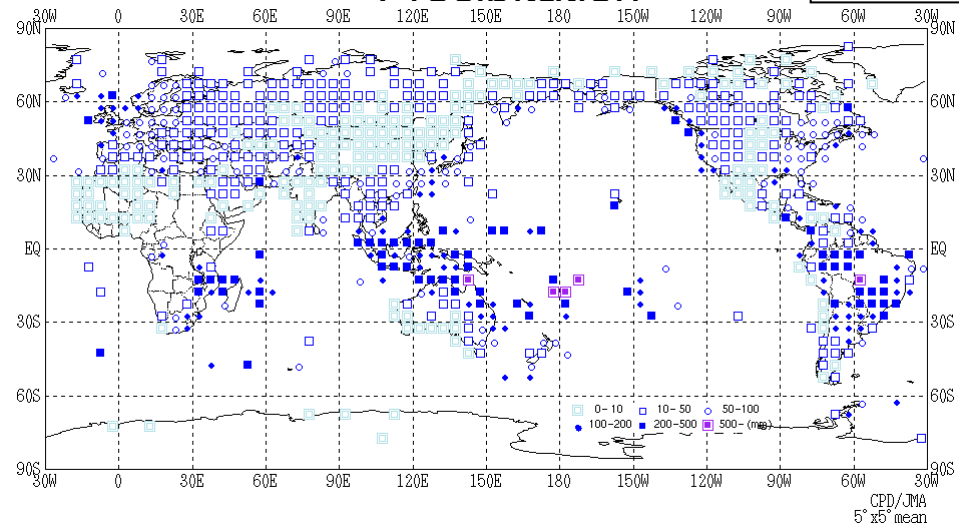
Temperature Anomaly



Normalized Temperature Anomaly

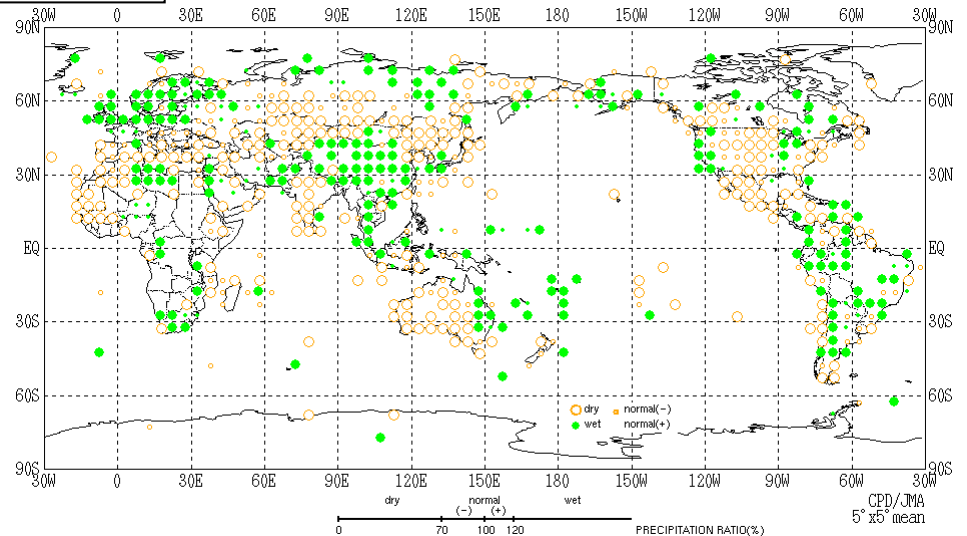


Precipitation



January 2008

Precipitation Ratio



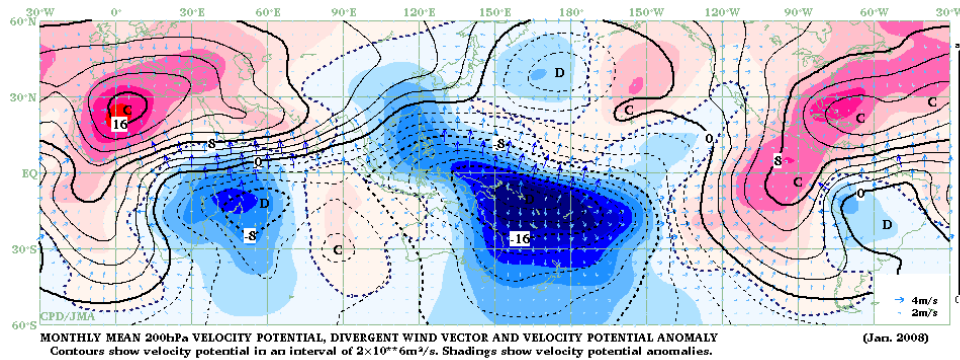


2.-1. Introduction to TCC

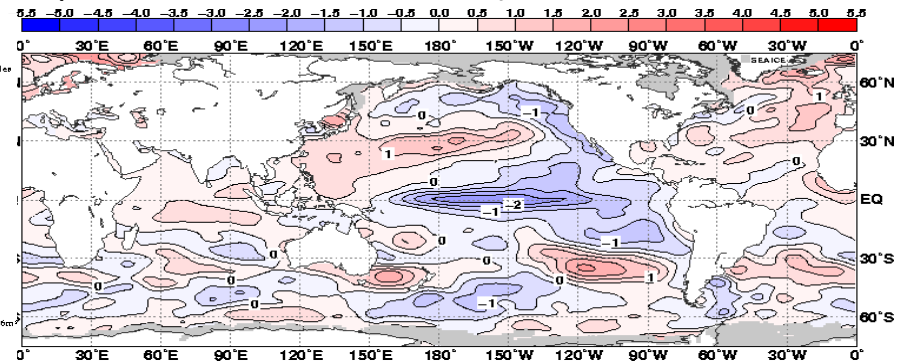
TCC Web page (Climate System Monitoring)

Summary → Monthly Highlights on Climate System

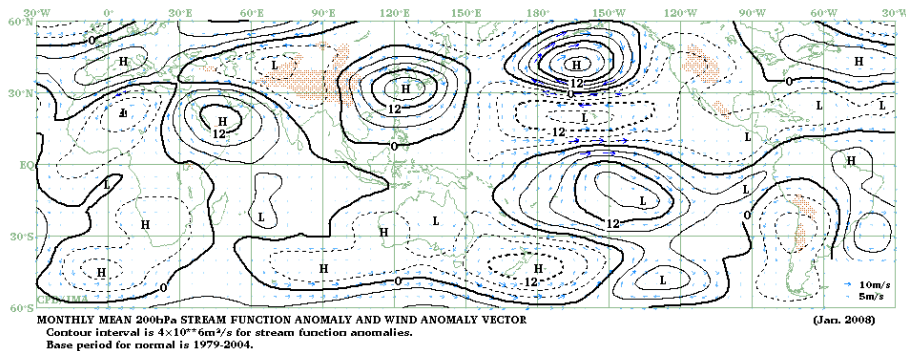
Velocity Potential and anomaly (JRA-25/JCDAS)



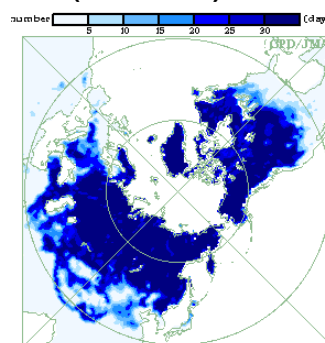
SST anomaly (COBE-SST)



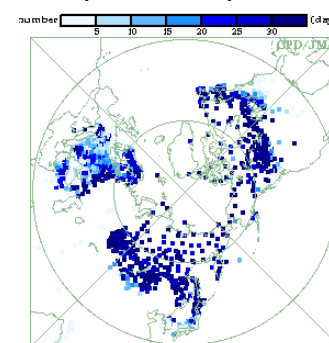
Stream function anomaly (JRA-25/JCDAS)



Snow distribution (SSM/I)



Snow depth (SNOP)





2.-1. Introduction to TCC TCC Web page (Climate System Monitoring)

Japan Meteorological Agency

Welcome to Tokyo Climate Center

HOME > Climate System Monitoring > Monthly Mean Figures

Monthly Mean Figures of Atmospheric Circulation, Snow and S

Region: Extratropics | Hist: Hist & Anom

Element & Pressure Surface: Sea Level Pressure & Anomaly in the Northern Hemisphere

Year: 2008 | Month: 1 | Draw

Oldest: -1 month | +1 month | Latest | Animation: Start | Stop | Slow | Fast | Direct

Normal

anomalies (hPa): -24 -20 -16 -12 -8 -4 0 +4 +8 +12 +16 +20 +24

MONTHLY MEAN SEA LEVEL PRESSURE AND ANOMALY IN THE NORTHERN HEMISPHERE (Jan. 2008)
Contours show sea level pressure in an interval of 4hPa.
Shaded patterns show SLP anomalies.
Base period for normal is 1979-2004.

Element & Pressure Surface

- Sea Level Pressure & Anomaly in the Northern Hemisphere
- Sea Level Pressure & Anomaly in the Northern Hemisphere
- 500hPa Height & Anomaly in the Northern Hemisphere
- 100hPa Height & Anomaly in the Northern Hemisphere
- 30hPa Height & Anomaly in the Northern Hemisphere
- 850hPa Temperature & Anomaly in the Northern Hemisphere
- 200hPa Wind Speed & Vectors in the Northern Hemisphere
- Wave Activity Flux at 300hPa in the Northern Hemisphere
- Sea Level Pressure & Anomaly in the Southern Hemisphere
- 500hPa Height & Anomaly in the Southern Hemisphere
- 100hPa Height & Anomaly in the Southern Hemisphere
- 30hPa Height & Anomaly in the Southern Hemisphere

Year: 2008

Oldest: 1979

Normal

anomal

1980

1981

1982

1983

1984

1985

1986

1987

1988

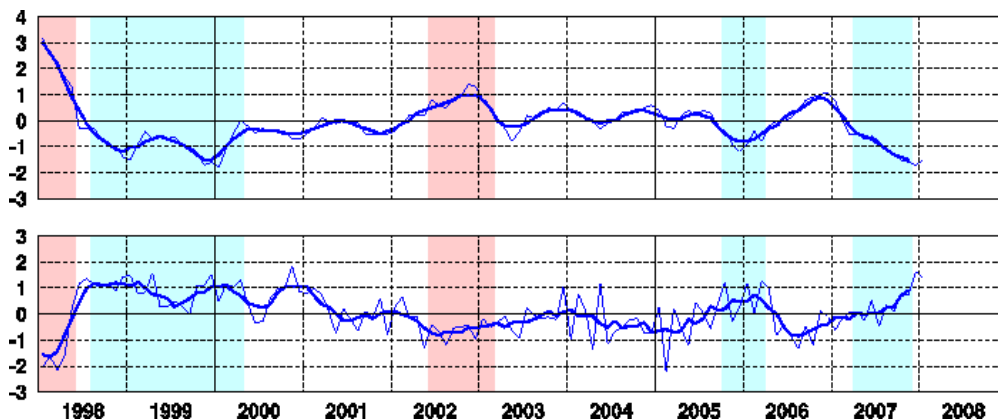
1989

Tokyo Climate Center, Climate Prediction Division, 1-3-4 Otemachi, Chiyoda-ku, Tokyo, Japan.

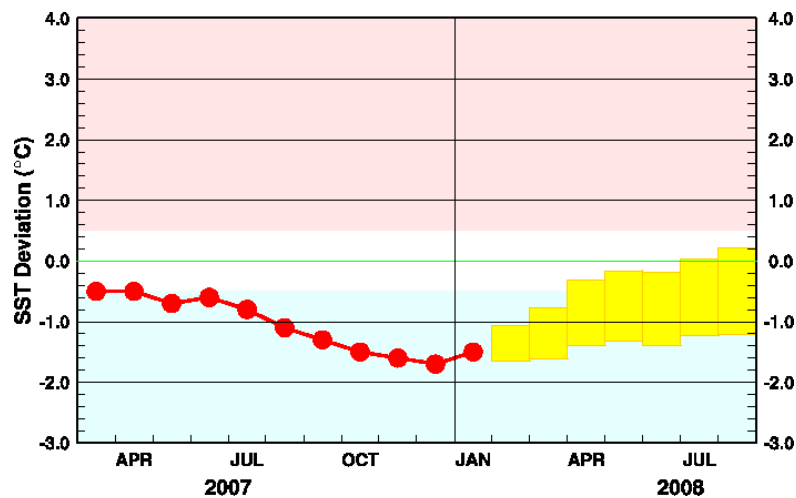


2.-1. Introduction to TCC

TCC Web page (El Niño Monitoring & outlook)

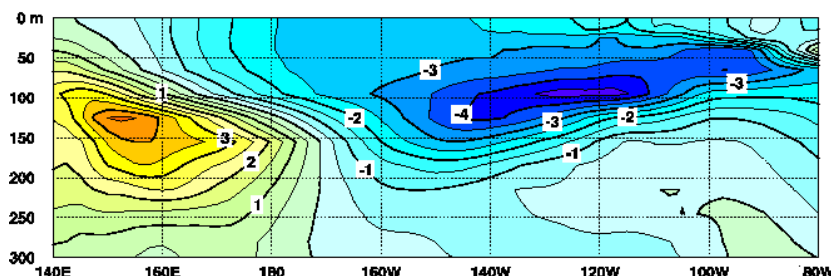
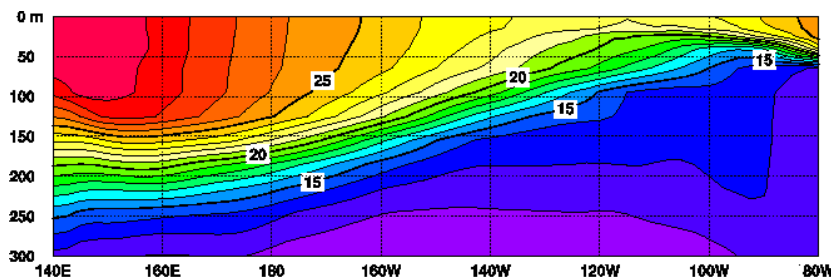


Time Sequence of ENSO indices
upper: Nino.3 SST lower: SOI



Outlook of the SST Deviation for Nino.3

Analysis: MOVE/MRI.COM-G
Forecast: JMA/MRI-CGCM



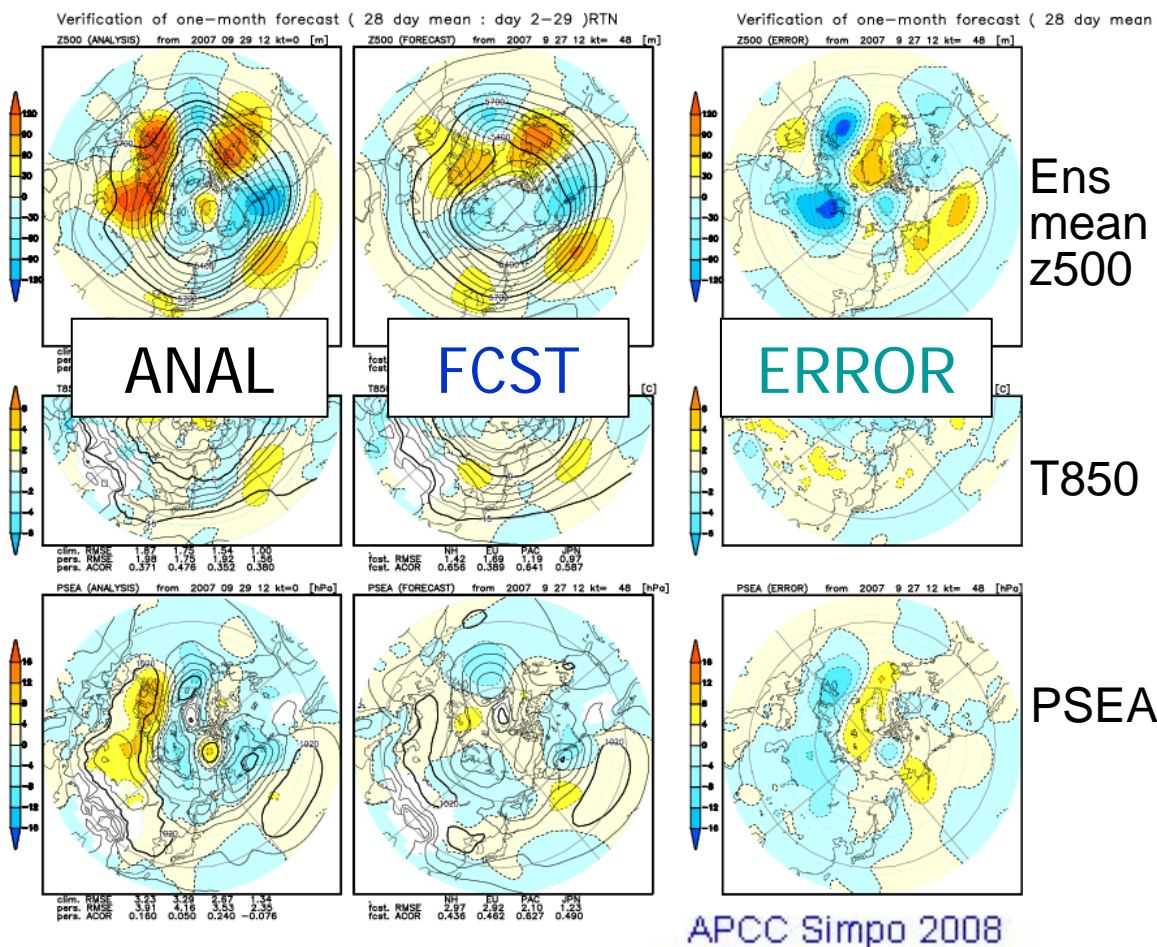
Longitude-Depth Cross-section of
Temperature(upper) and Anomaly(lower)
along the Equator (January 2008)



2.-1. Introduction to TCC

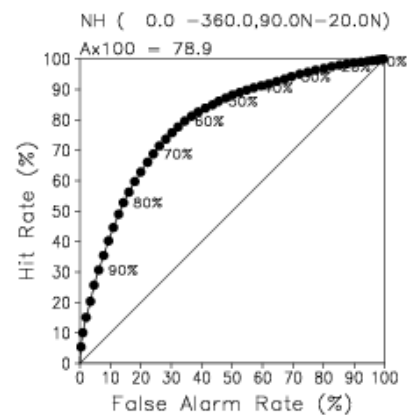
TCC Web page (NWP Model Prediction)

One month Forecast : Every Friday
Three-month Forecast : Every month (around 25th)
Warm/Cold season Forecast : Feb., Mar. and Apr. (Warm season)
 Sep. and Oct. (Cold season)



One-month forecast
 28-day average
 Initial: 27 Sep, 2007

Verification is also available on TCC web site.



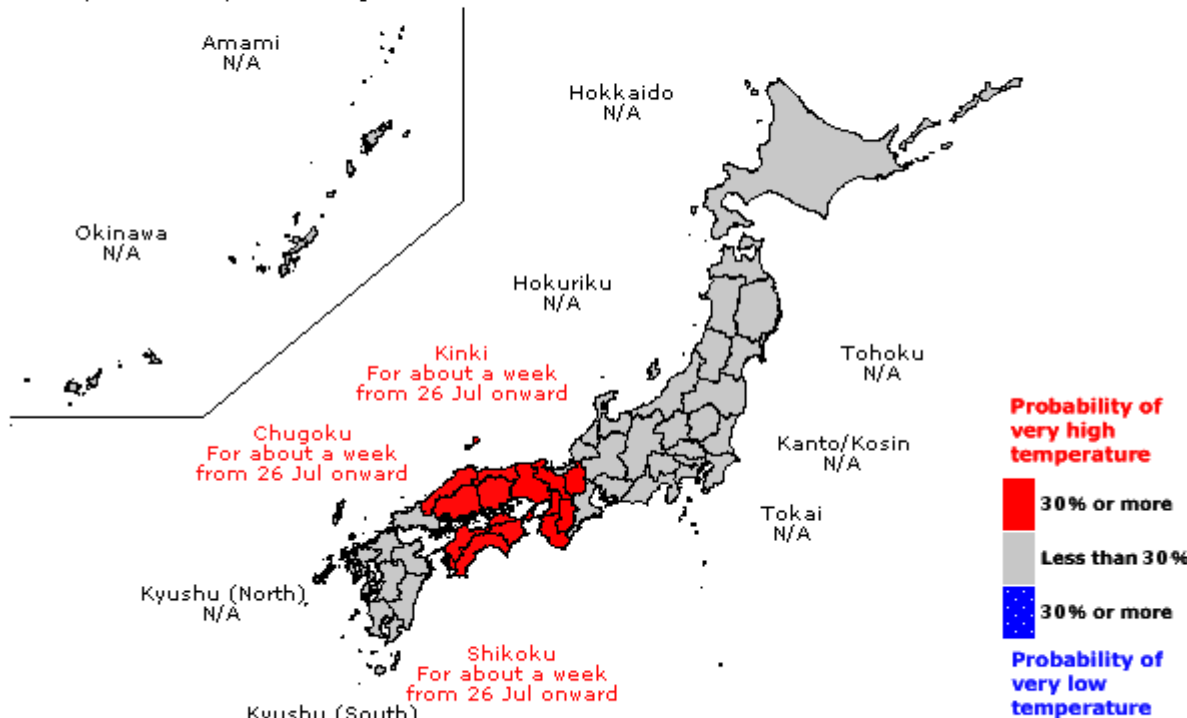


2.-1. Introduction to TCC TCC Web page (**Climate in Japan**)

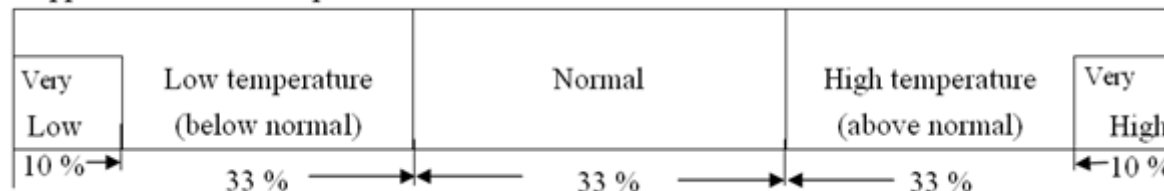
7-day Averaged Temperature (Issued: 18 July 2008)

Forecast period: 23 July - 1 August

This chart shows areas where the predicted probability of very high or very low seven-day averaged temperature is 30% or more. The predicted period is given below the name of the area.



Appearance rate of temperature



APCC Simpo 2008

➤ Early Warning Information on Extreme Weather is issued on every Tuesday and Friday

➤ when a high probability (30% or more) of very high or very low seven-day averaged temperature is predicted

➤ in the week starting from five to eight days ahead of the date of announcement. (in the second week)



Widely used as reliable and useful Information

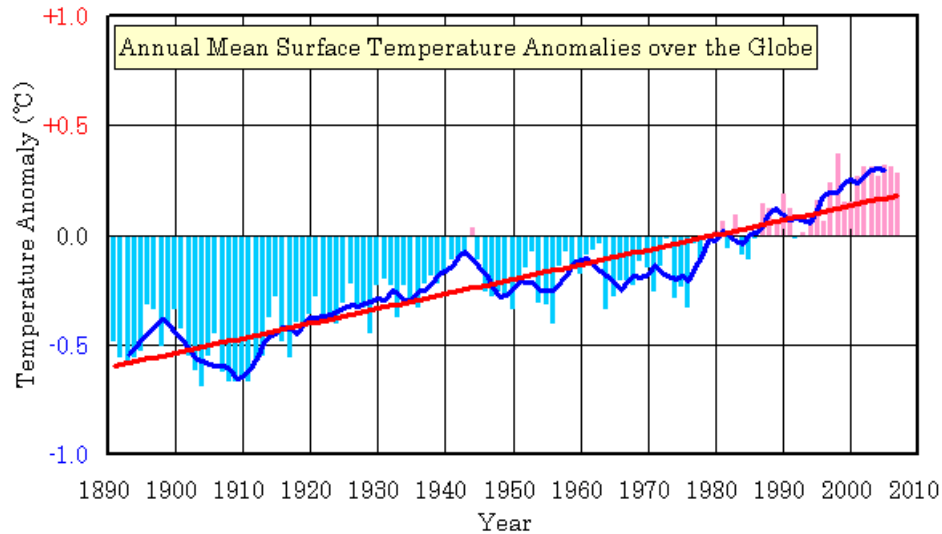


2.-1. Introduction to TCC

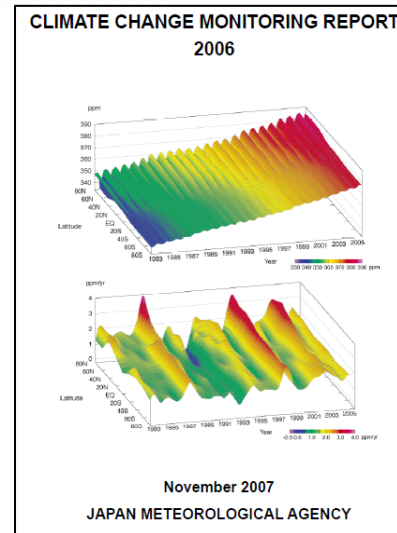
TCC Web page (**Global Warming**)

Global Temperature Monitoring

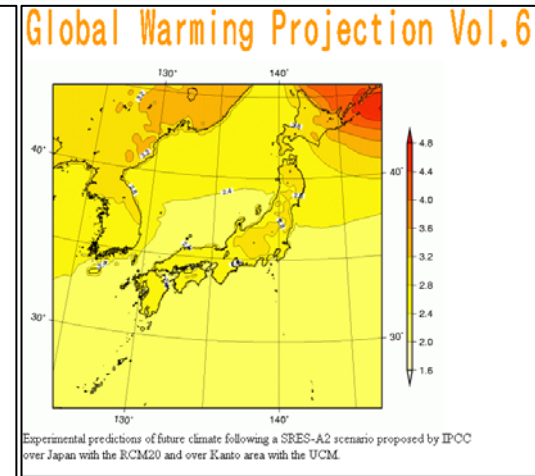
Annual anomaly of surface temperature over the globe (combined temperature of near-surface air temperature over land, and sea surface temperature)



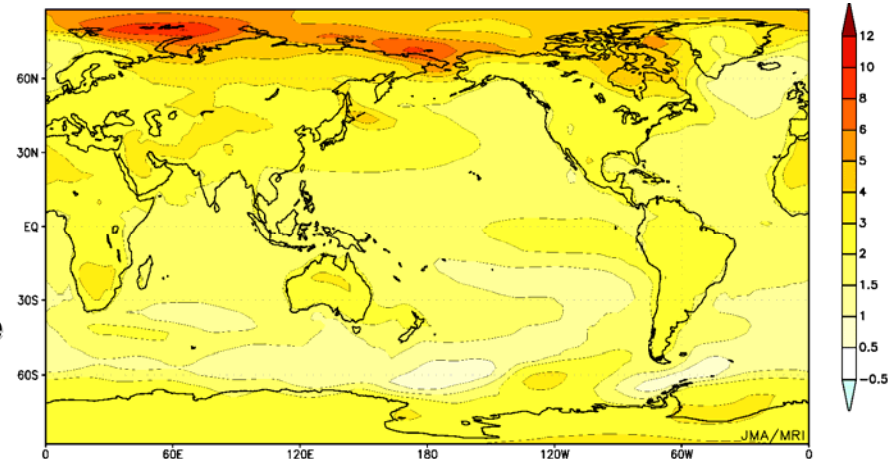
Projected change in the annual mean temperature for the SRES scenario A2 (Unit: °C)



Climate Change Monitoring Report



Global Warming Projection Report



the change from 2071 to 2100 relative to the period from 1971 to 2000



2.-1. Introduction to TCC TCC Web page (ClimateView)

Monthly data --- map

If you move your mouse to the observation points on the map, the point's name and data which you chose in "Search form" are shown.
Please click the point to see the chart of monthly data.

Search Form

Region: Asia/Siberia Element: Mean Temp. Year/Month: << < 2008 > >> Show

[<< ClimatView TOP](#)
[Data List >>](#)
[Printable >>](#)

"Data List" and "Printable" buttons are available after pushing "Show" button.

Search Form

Year/Month: << < 2008 > >> Term: 2 years Show

[<< Map](#)
[Printable >>](#)

TOKYO [JAPAN]

— Mean Temp. (degC)
 — Max. Temp. (Monthly Mean) (degC)
 — Min. Temp. (Monthly Mean) (degC)
 — Mean Temp. Normal (degC)
 ■ Precip. (mm)
 □ Precip. Normal (mm)
 x No data

TOKYO - JAPAN
 Lon.: 139.77°E / Lat.: 35.68°N Height: 6(m)

Download --- download in text file

Year/Month	Observation			Normal	
	Mean Temp. [degC]	Max. Temp. (Monthly Mean) [degC]	Min. Temp. (Monthly Mean) [degC]	Precip. [mm]	Precip. [mm]
2006-7	25.6	28.6	23.3	165.0	161.5
2006-8	27.5	31.1	24.8	126.0	155.1
2006-9	23.5	27.1	20.7	176.0	208.5

2008-06: [Mean Temperature(degC)]



2.-1. Introduction to TCC TCC Web page (ClimateView)

Search Form

Region: Element: Year/Month:

[« ClimatView TOP](#) [Data List »](#) [Printable »](#)

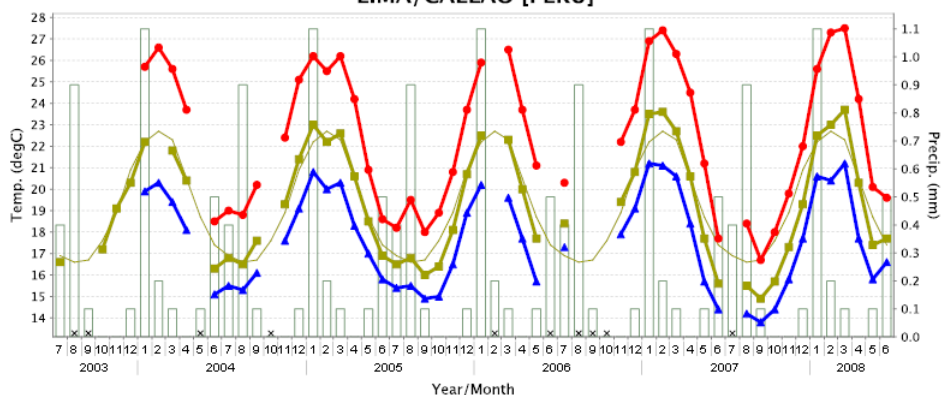
"Data List" and "Printable" buttons are available after pushing "Show" button.

Search Form

Year/Month: Term:

[« Map](#) [Printable »](#)

LIMA/CALLAO [PERU]

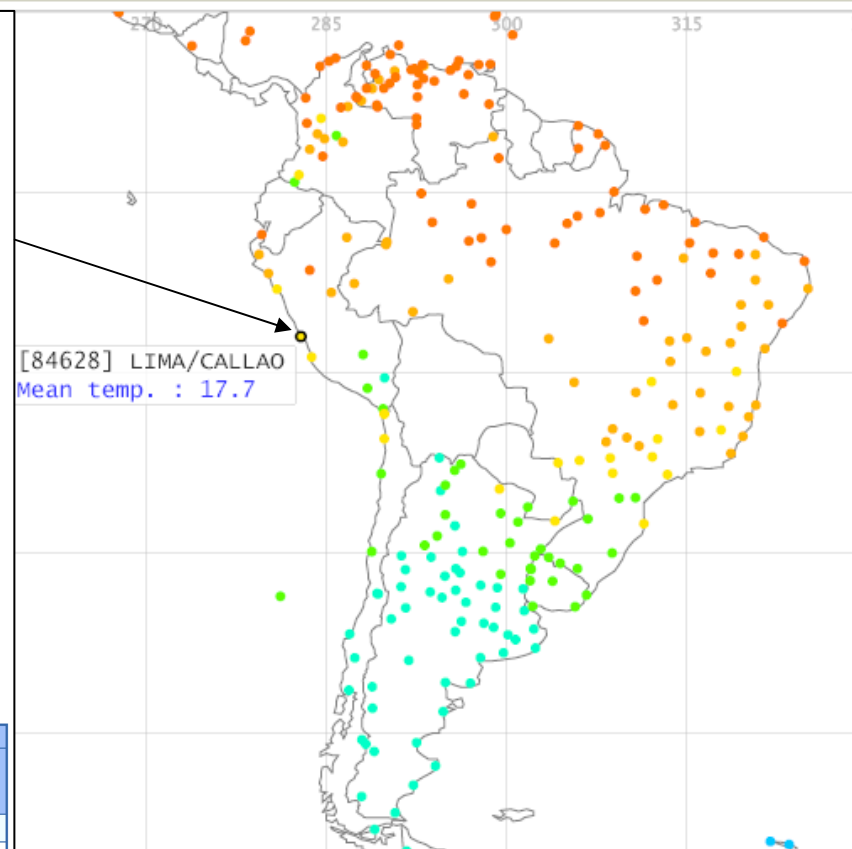


Mean Temp. Max.Temp.(Monthly Mean) Min.Temp.(Monthly Mean) Mean Temp. Normal Precip. Precip. Normal
 No data

LIMA/CALLAO - PERU
Lon.: 77.12°W / Lat.: 12.02°S Height: 12(m)

--- download in text file

Year/Month	Observation			Normal		
	Mean Temp. [degC]	Max. Temp. (Monthly Mean) [degC]	Min. Temp. (Monthly Mean) [degC]	Precip. [mm]	Mean Temp. [degC]	Precip. [mm]
2003-7	16.6			0.0	16.9	0.4
2003-8					16.6	0.9
2003-9					16.7	0.1
2003-10	17.2			0.0	17.6	0.0



[84628] LIMA/CALLAO
Mean temp. : 17.7

[Mean Temperature(degC)]



2.2 Statistical Down Scaling

One month probabilistic forecasts at station points

- **Japan Meteorological Agency (JMA) has started probabilistic one-month forecast for 7day-average surface temperature and 14day-average precipitation.**
- **The Model Output Statistics (MOS) technique based on the 20 years (1982-2001) hindcasts generate the forecasts,**
- **The Gauss-distribution method is used as the statistical tool of the MOS. The thresholds of tercile are determined as making each category become 33.3% of station's observation in 1982-2002.**



2.-2 Statistical Down Scaling

One month probabilistic forecasts at station points

Climate in the World | Climate System Monitoring | El Niño Monitoring | NWP Model Prediction | Global Warming | Climate

OME > NWP Model Prediction > Probabilistic forecasts > Probabilistic forecasts map

Probabilistic forecasts map

If you move your mouse over the observer point, the name and histogram which you chose are appeared. Please click the point to see the chart of

Initial forecast time
24 Jul 2008

Lead time
2-15

forecast element
Precipitation

Region
SouthEast-Asia

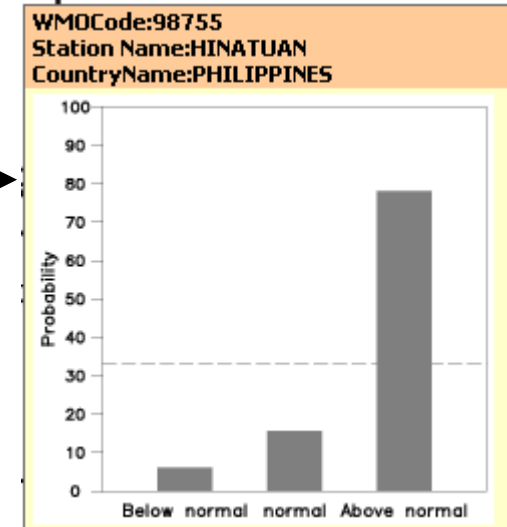
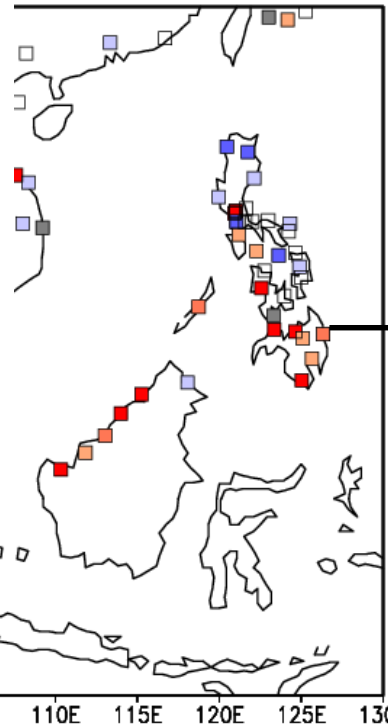
Initial forecast time
24 Jul 2008

Lead time
2-15

3-16
4-17
5-18
6-19
7-20
8-21
9-22
10-23
11-24
12-25
13-26
14-27
15-28
16-29

name and histogram which you chose are appeared.

(Fri) - 2008/08/07(Thu) [14 days average]



BN NM AN

Initial forecast time
Lead time
Forecast element
Region

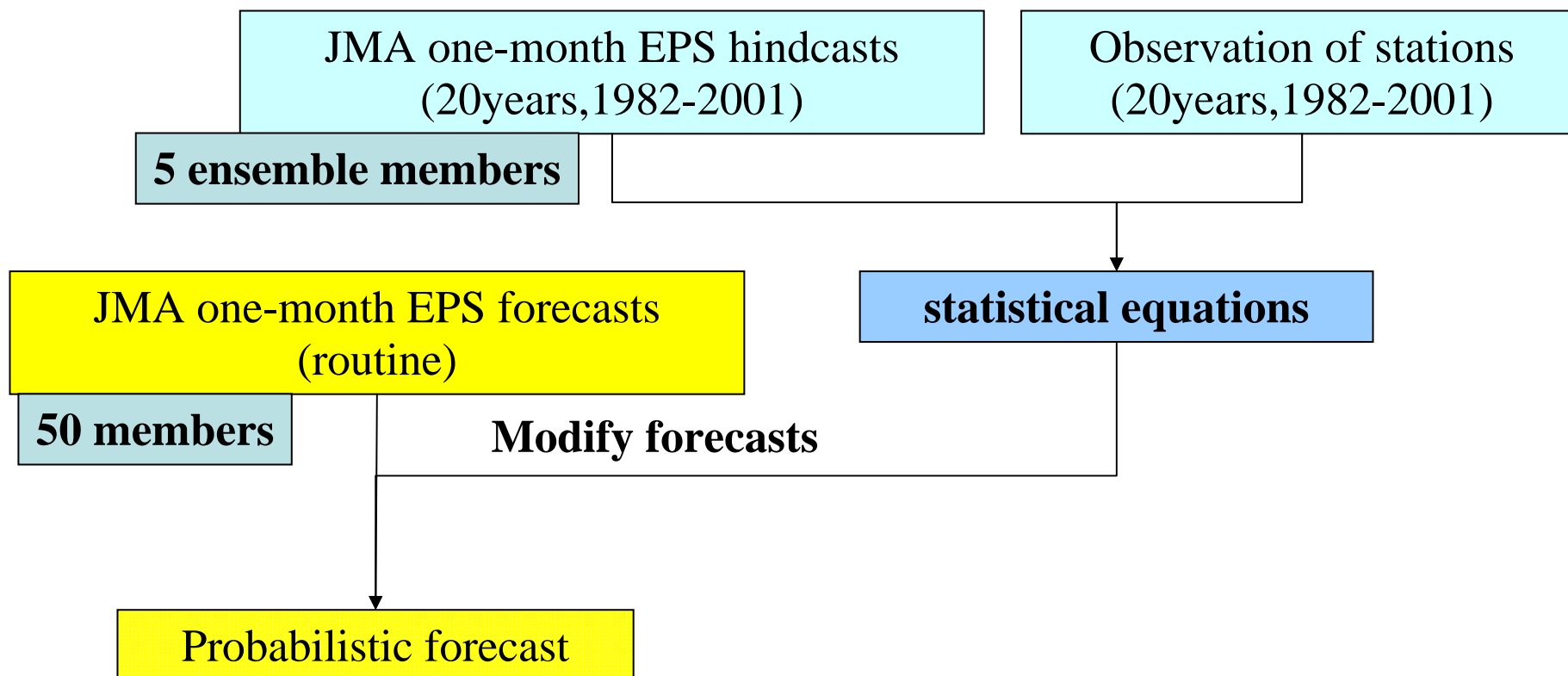
[« download text](#)



2.2 Statistical Down Scaling

One month probabilistic forecasts at station points

For Forecasts

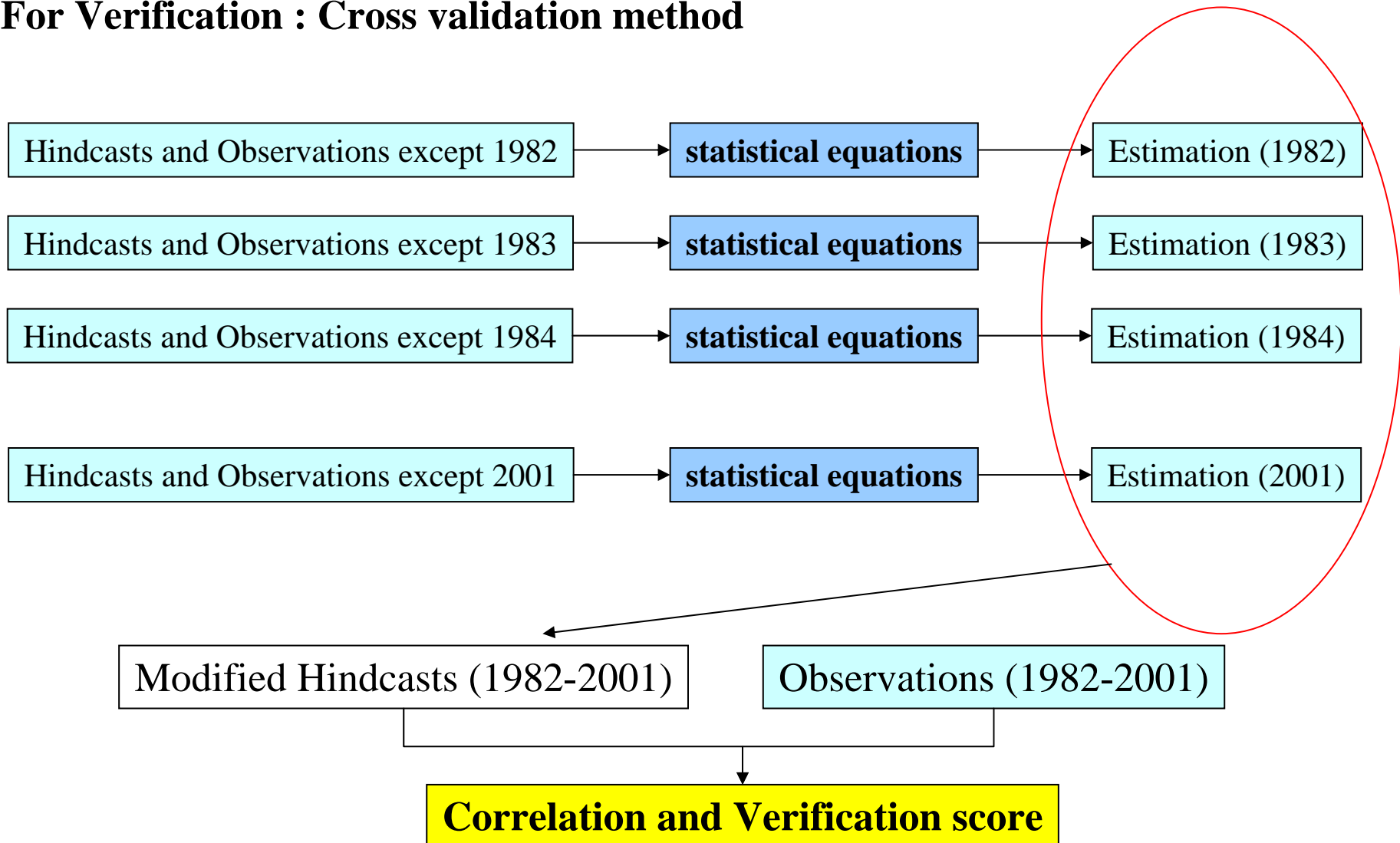




2.2 Statistical Down Scaling

One month probabilistic forecasts at station points

For Verification : Cross validation method





2.2 Statistical Down Scaling

One month probabilistic forecasts at station points

Techniques used in statistical down scaling

Multiple regression formula:

- Multiple regression : $Y = A_1X_1 + A_2X_2 + \dots + B$
- Method of variable selection : **Stepwise selection**
- selected variables vary in points and seasons**

Four seasons:

- winter dry season (Jan-Mar)
- pre-monsoon season (Apr-May)
- summer monsoon season (Jun-Sep)
- post-monsoon season (Oct-Dec)

For example

$$\begin{aligned} \text{Modified forecast} &= A_1 \text{ forecast} + A_2 X_2 \longrightarrow \text{station1} \\ \text{Modified forecast} &= A_1 \text{ forecast} + A_2 X_2 + A_3 X_3 \longrightarrow \text{station2} \end{aligned}$$



2.2 Statistical Down Scaling

One month probabilistic forecasts at station points

Selectable predictors in Multiple Regression:

-**model precipitation** (to power of $1/4$) or **model 2m temperature**

-**topographical upward motion** ($\vec{U}_{850} \times \text{slope of terrain}$)
(eight kinds of terrain data from 0.083 to 1.25 degree)

$$\text{Topographical factor} = \vec{U}_{850} \cdot \nabla h \quad \begin{array}{ll} > 0 & \text{upward motion} \\ < 0 & \text{downward motion} \end{array}$$

-**MJO-Index (RMM1 and RMM2)** (Wheeler and Hendon, 2004)
EOFs of near-equatorially averaged 200hPa velocity potential and 850hPa and 200hPa U (zonal wind)
RMM1 and RMM2 are time coefficients of EOF1 and EOF2.

-**NINO.3.SST anomaly** (5S-5N, 150W-190W)
using previous month value



2.2 Statistical Down Scaling

One month probabilistic forecasts at station points

Independent variables:

-Observation data source

APN Workshop data ,
ASEAN project on climate statistics,
GSN(GCOS Surface Network),
SYNOP reports,
GAME project

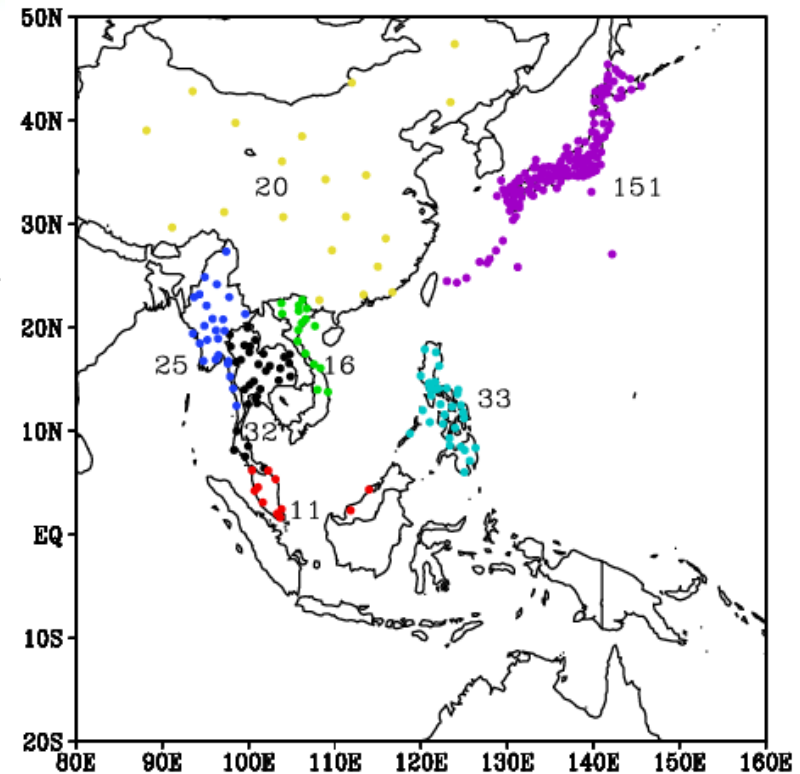
-Selection target stations

-Period for making climatology

1971 ~ 2001 : 24 years or longer with 330
days or more with available
daily observation

-Period of hindcasts

1982 ~ 2001 : 16 years or longer with 330
days or more with available
daily observation



312 station points including
151 Japanese stations



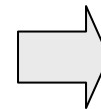
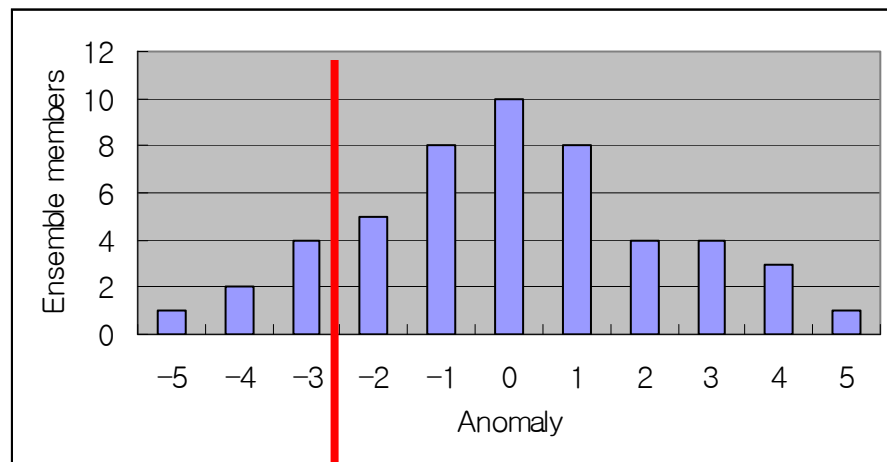
2.2 Statistical Down Scaling

How to make probability

Base method

Make probability directly from the anomaly of all ensembles members of forecasts

For example : probability of below normal (< -2)



Probability of below normal

$$7 / 50 \times 100 = 14 \%$$

7 members

43 members = 50 members



2.2 Statistical Down Scaling

How to make probability

Gauss-distribution method

Assumption : Observation ,ensemble mean forecast and noise are normally distributed.

$$\sigma_y^2 = \sigma_s^2 + \sigma_n^2$$

$$\sigma_n^2 = (1 - r^2) \sigma_y^2$$

σ_y : Standard deviation of observation

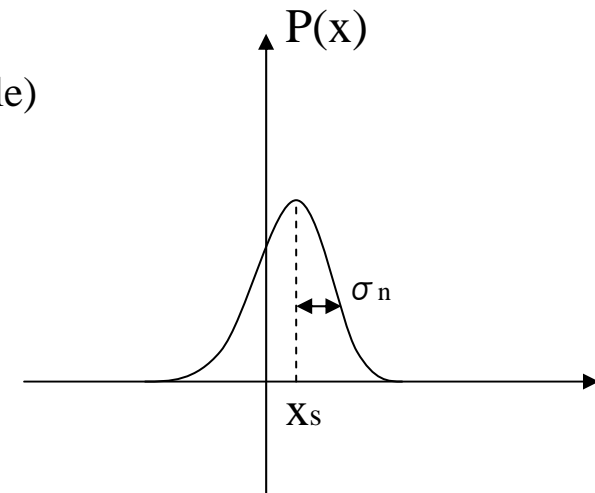
x_s : Ensemble mean forecast (single or multiple regression)

σ_s : Standard deviation of Ensemble mean forecast

σ_n : Standard deviation of noise

r : Correlation coefficients (no-regression or single or multiple)

$$P(y) = \frac{1}{\sqrt{2\pi}\sigma_n} \exp\left(-\frac{(y-x_s)^2}{2\sigma_n^2}\right)$$





2.2 Statistical Down Scaling

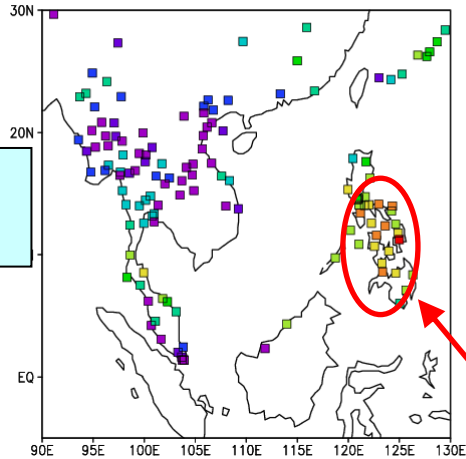
Correlation of 28days (2nd-29th day forecast) average of precipitation with station observation

Based on
10 years HC
(11members)

Winter dry
season

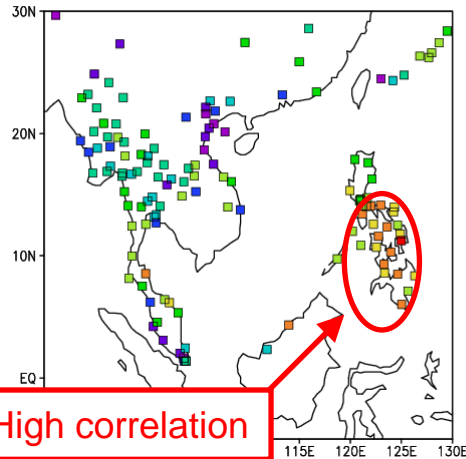
Single regression

Correlation coefficient
Single regression jack(precipitation)
Winter dry season (init month Jan - Mar)



Multiple regression

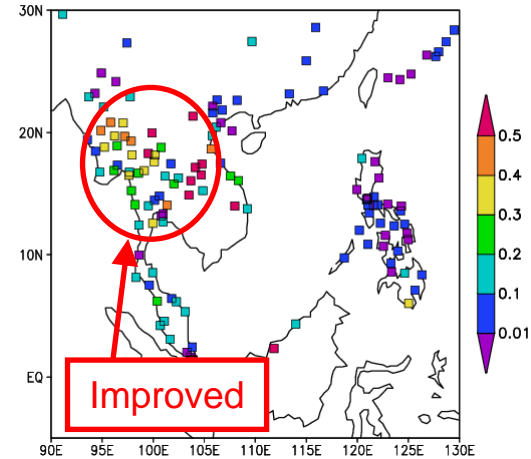
Correlation coefficient
Multi regression (precipitation)
Winter dry season (init month Jan - Mar)



High correlation

Multiple-Single

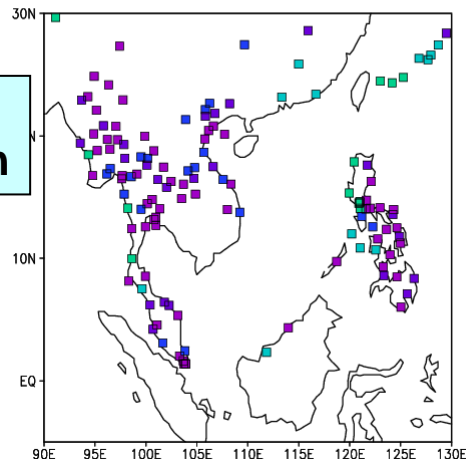
Correlation coefficient
Multi - Single (precipitation)
Winter dry season (init month Jan - Mar)



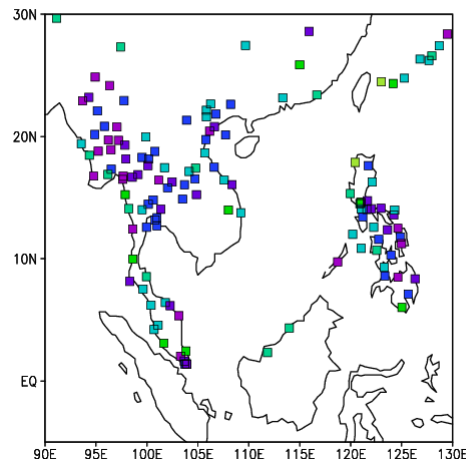
Improved

Summer
monsoon

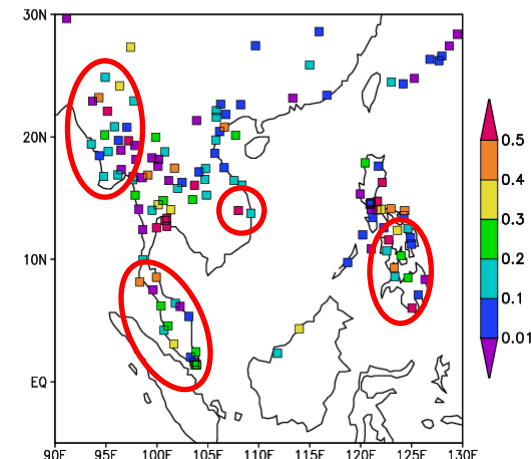
Correlation coefficient
Single regression jack(precipitation)
Summer monsoon (init month Jun - Sep)



Correlation coefficient
Multi regression (precipitation)
Summer monsoon (init month Jun - Sep)



Correlation coefficient
Multi - Single (precipitation)
Summer monsoon (init month Jun - Sep)





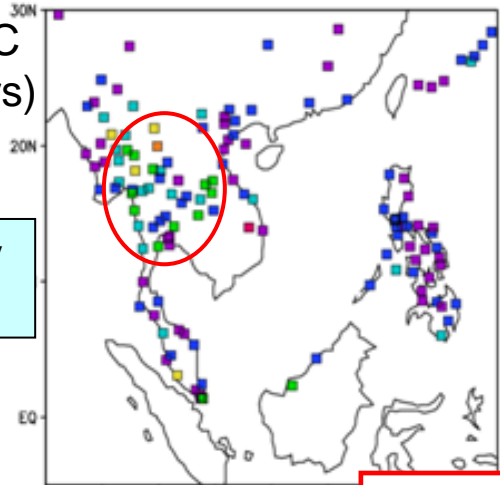
2.2 Statistical Down Scaling

Defereence of Correlation, **Multiple – Single regression** for 14 days (2nd-15th) and 28 days (2nd-29th) average with station observation

Based on
10 years HC
(11members)

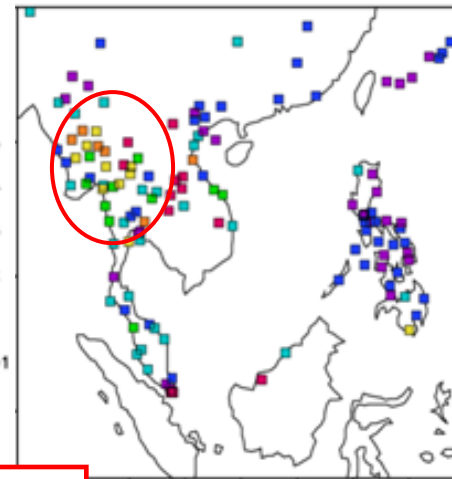
Winter dry
season

14 days Precipitation



Correlation coefficient
Multi – Single (precipitation)
Summer monsoon (init month Jun – Sep)

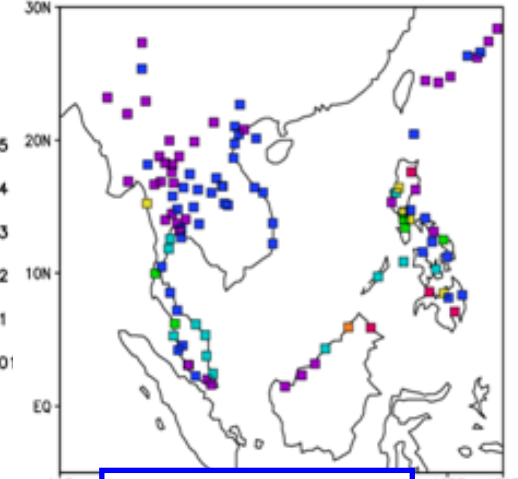
28 days Precipitation



more improved
for 28 days

Correlation coefficient
Single (precipitation)
monsoon (init month Jun – Sep)

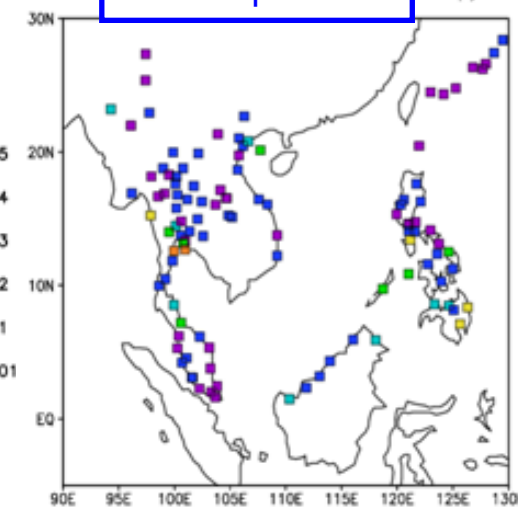
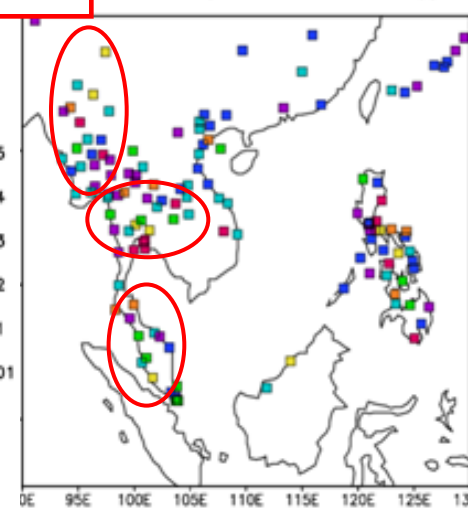
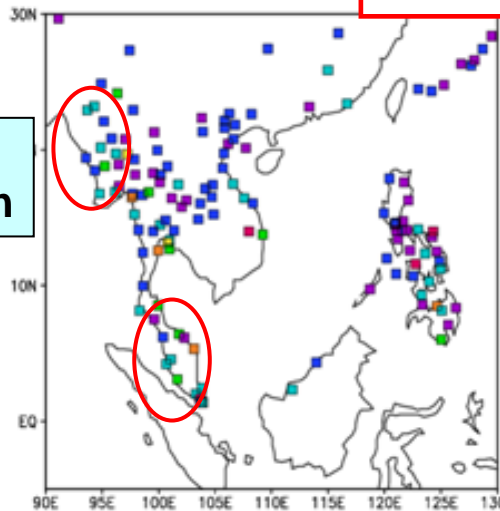
14 days Temperature



Correlation coefficient
Multi – Single (Temperature)
Summer monsoon (init month Jun – Sep)

less improved
for Temperature

Summer
monsoon

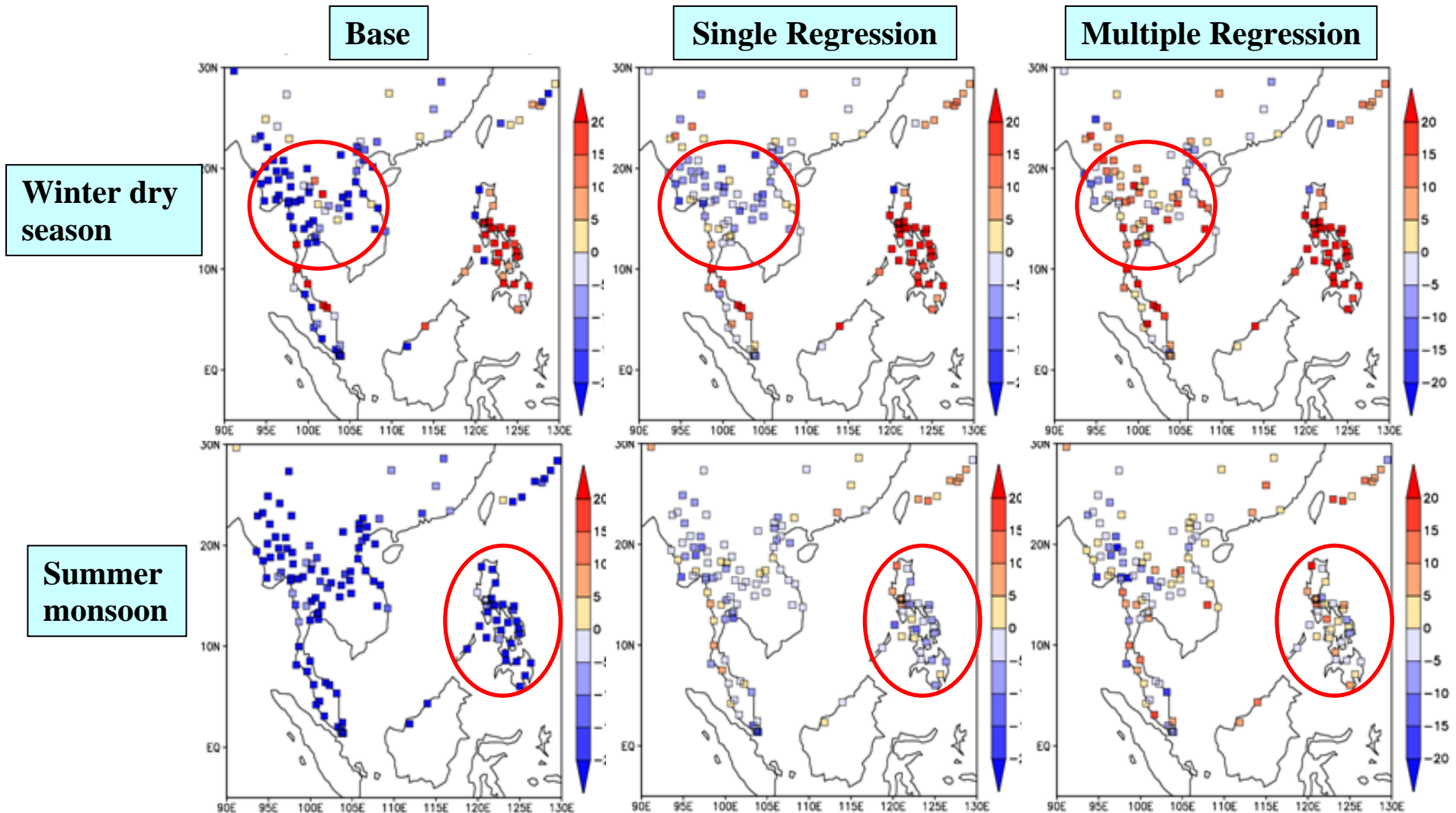




2.2 Statistical Down Scaling

Verification of one month probabilistic forecasts at station points

28 days (2nd–29th) average precipitation Cross-validation BSS (Above Median)





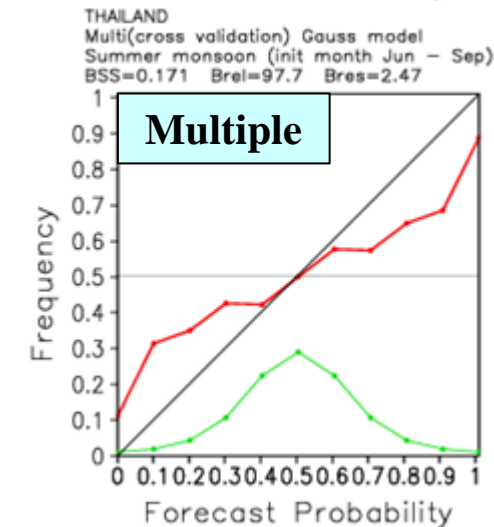
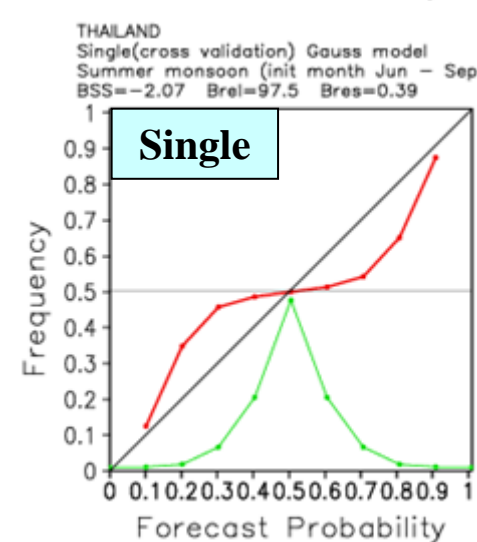
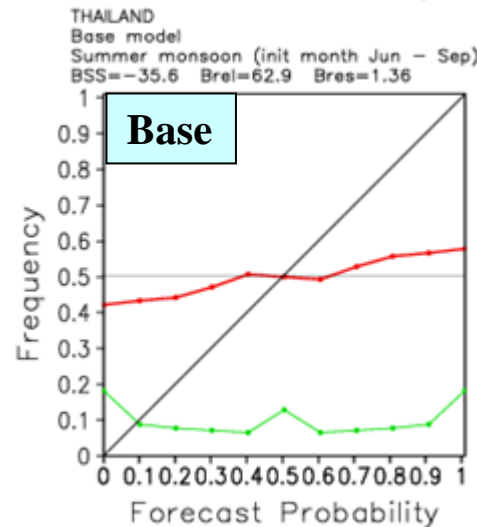
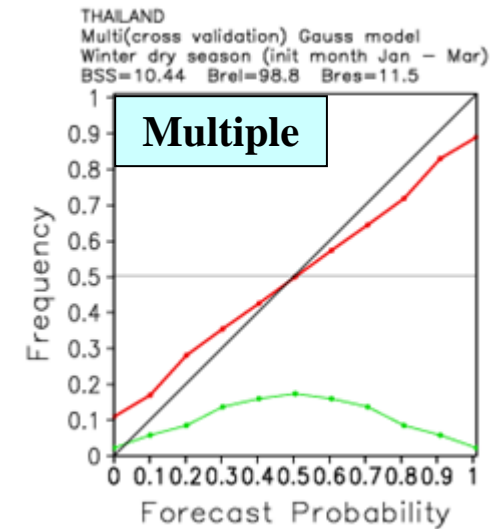
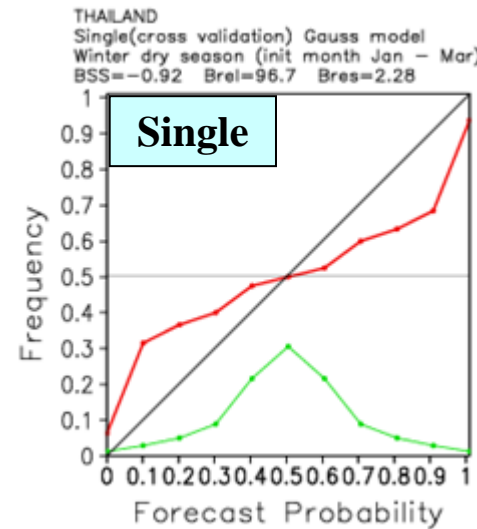
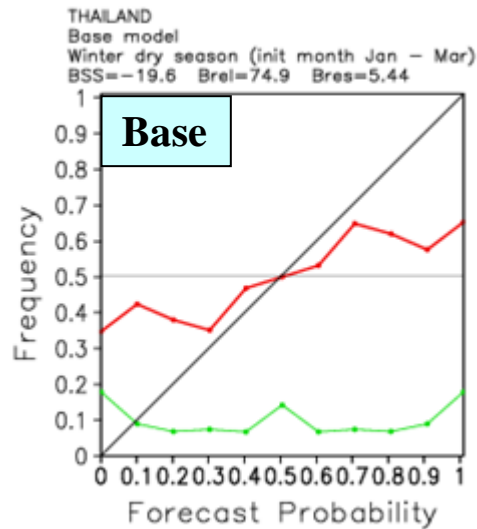
2.2 Statistical Down Scaling

Verification of one month probabilistic forecasts at station points

28 days (2nd–29th) average precipitation Cross-validation **Reliability Diagram** (Above Median)

Thailand

Winter dry season



Summer monsoon



2.2 Statistical Down Scaling

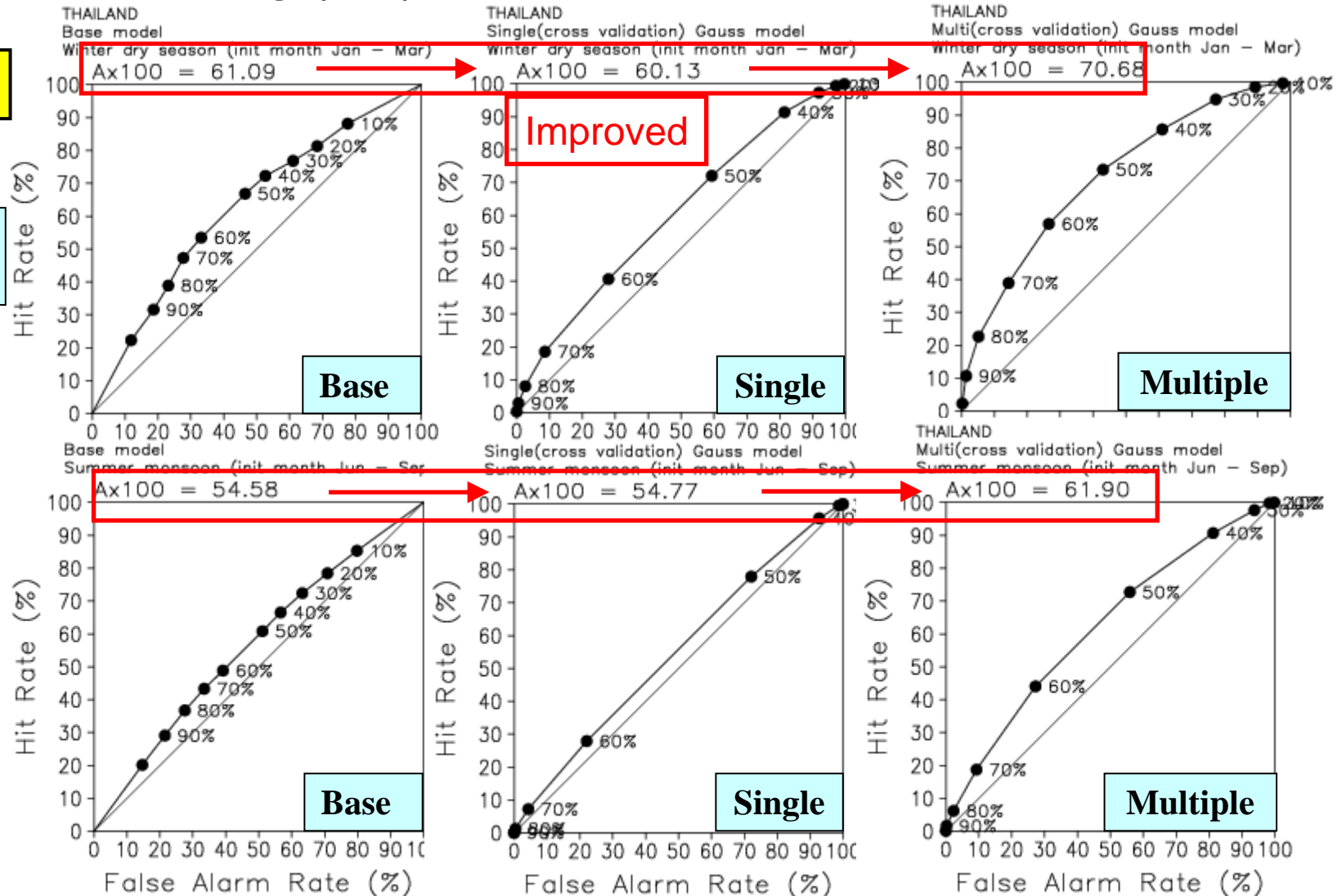
Verification of one month probabilistic forecasts at station points

28 days (2nd–29th) average precipitation Cross-validation ROC curve (Above Median)

Thailand

Winter dry season

Summer monsoon





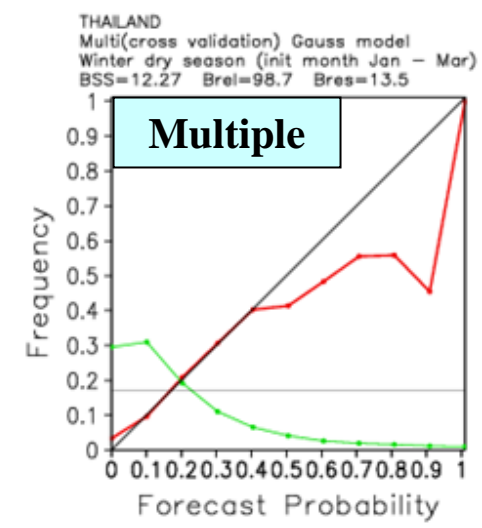
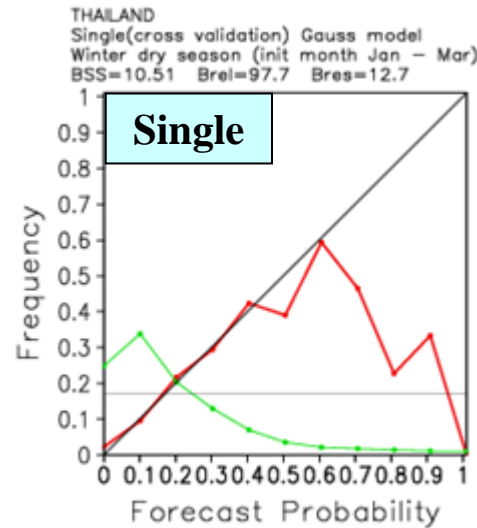
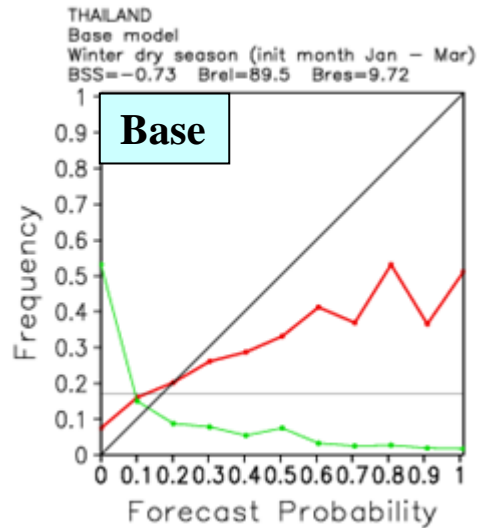
2.2 Statistical Down Scaling

Verification of one month probabilistic forecasts at station points

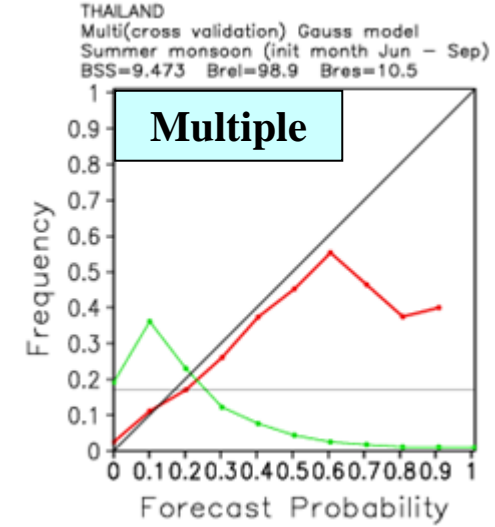
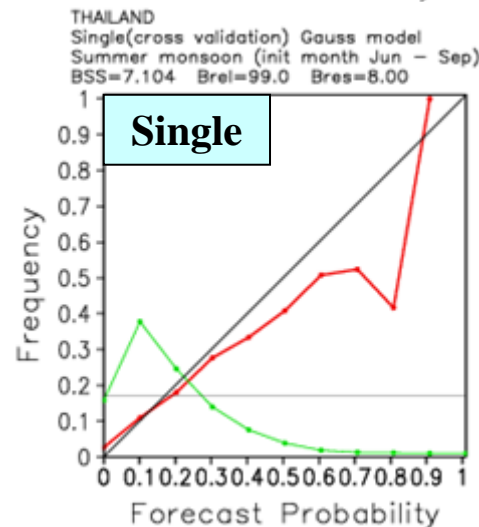
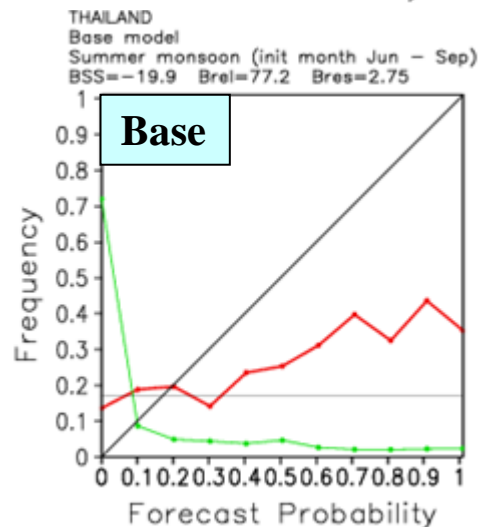
7 days (9th–15th) average 2mT Cross-validation **Reliability Diagram** (Above/Blow SD)

Thailand

Winter dry season



Summer monsoon





2.2 Statistical Down Scaling

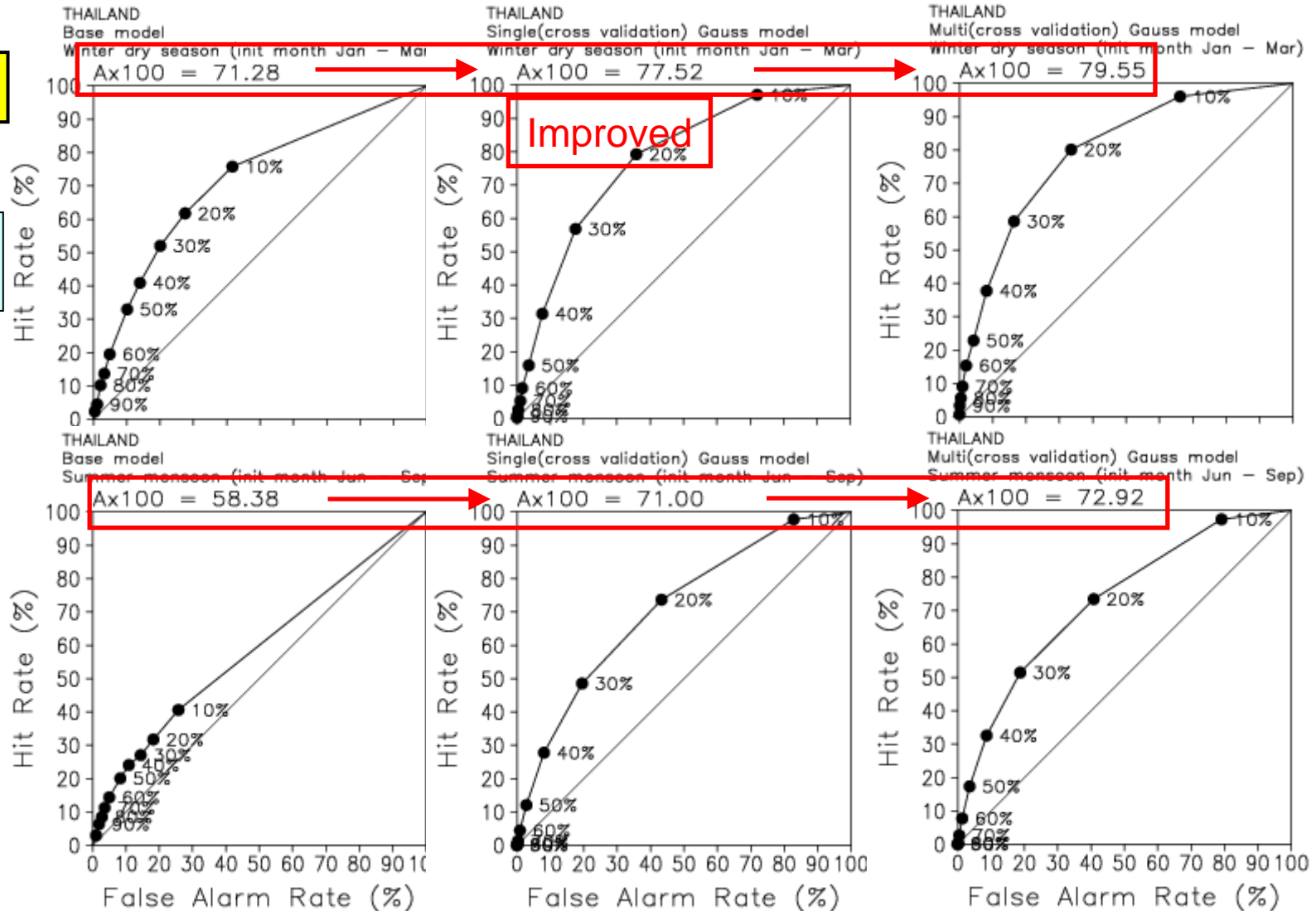
Verification of one month probabilistic forecasts at station points

7 days (9th–15th) average 2mT Cross-validation ROC curve (Above/Blow SD)

Thailand

Winter dry season

Summer monsoon





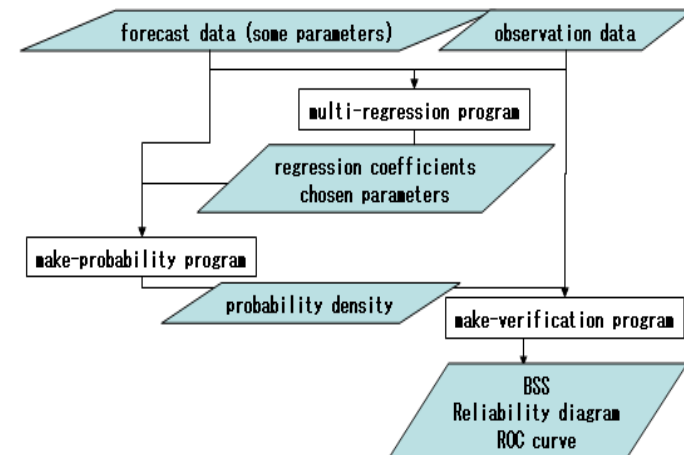
2.2 Statistical Down Scaling

TCC's Support to NHMSs

- ◆ Through the TCC web page, users can access to the latest probabilistic forecast at selected stations over the Southeast Asia and Japan.
- ◆ Users can download a sample code for the statistical downscaling through the TCC web page
http://ds.data.jma.go.jp/tcc/tcc/products/guidancetst/download_src.html with the manual documentation.
- ◆ TCC disseminates the use of this services through seminars and training courses.



Meeting in TMD on 6 March



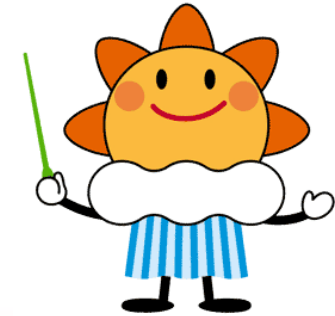


3. Summary

- **Seasonal Prediction is one of important tasks for JMA.**
- **Tokyo Climate Center (TCC) is responsible for supporting NHMSs as a center for climate information in the Asia-Pacific region (RCC).**
- **Major functions of TCC is as follows.**
 - **Provision of Climate information**
Climate (system) monitoring, Seasonal forecasts, El Niño monitoring and outlook, Global Warming
 - **Capacity Building (Seminar, training course, etc)**
- **One month **probabilistic forecasts at station points** is new useful information as an application of numerical prediction with **statistical downscaling** technique, especially for the Southeast Asian region.**



Thank you
for your attention



JMA



View from CPD/JMA



2.2 Statistical Down Scaling

Frequency ratio of selection of each predictor in the Southeast Asia and Japan

most frequent

secondly frequent

14 days average (2nd-15th) precipitation

Southeast Asia(%)	Model precipitation	Inner product of U and land slope gradient	MJO index	NINO3 SSTA
Winter dry season	93	45	32	51
Pre monsoon	80	43	60	46
Summer monsoon	83	59	61	22
Post monsoon	95	64	77	40

28 days average (2nd-29th) precipitation

Southeast Asia(%)	Model precipitation	Inner product of U and land slope gradient	MJO index	NINO3 SSTA
Winter dry season	77	61	46	67
Pre monsoon	58	48	52	61
Summer monsoon	50	56	82	39
Post monsoon	89	66	70	50

Japan(%)	Model precipitation	Inner product of U and land slope gradient	MJO index	NINO3 SSTA
Winter dry season	91	35	58	56
Pre monsoon	76	28	48	36
Summer monsoon	96	52	58	34
Post monsoon	87	30	66	19