

WMO LC-LRFMME

WMO Lead Centre for
Long-Range Forecast Multi-Model Ensemble



Goal

Provide a conduit for sharing global prediction models

Develop a well-calibrated MME system and user-friendly services



Maximize the benefit from favorable climate conditions



History

» WMO GPC meeting
(October, Korea)

KMA suggested
the need of LC-LRFMME

2005

Oct

» WMO CBS-Ext.06
(November, Korea)

The commission encouraged
GPCs to provide their data to
LC-LRFMME

2006

Apr

Nov

» Expert Team on LRF
(April, England)

Objectives and functions
of the LC were defined
by ET of WMO / CBS / DPFS

2007

Jun

» LC-LRFMME established
the data exchange system
(June)



History

» WMO CBS-XIV
(April, Croatia)

LC-LRFMME was
officially endorsed

2009

Apr

» WMO Cg-XVI
(May, Switzerland)

Cg-XVI requested to expand
its role to include exchange of
extended-range predictions

2011

Apr

May

2016

Present

» LC-LRFMME started
to provide Probabilistic MME
predictions in terms
of tercile-based categorical
probabilities (April)

» LC-LRFMME has developed
the pilot real-time
MME system
for sub-seasonal forecast



Background

12 WMO-designated Global Producing Centres (GPCs) for long-range forecasts

- adhering to agreed procedures/ standards in delivery of global long-range forecasts (e.g. products, timeliness, verification/ validation info, system documentation)

Linkage is needed among GPCs and other organizations including NMHSs, RCCs and RCOFs to ensure wider and more effective use of LRF



12 WMO GPCs for LRF

WMO Global Producing Centres

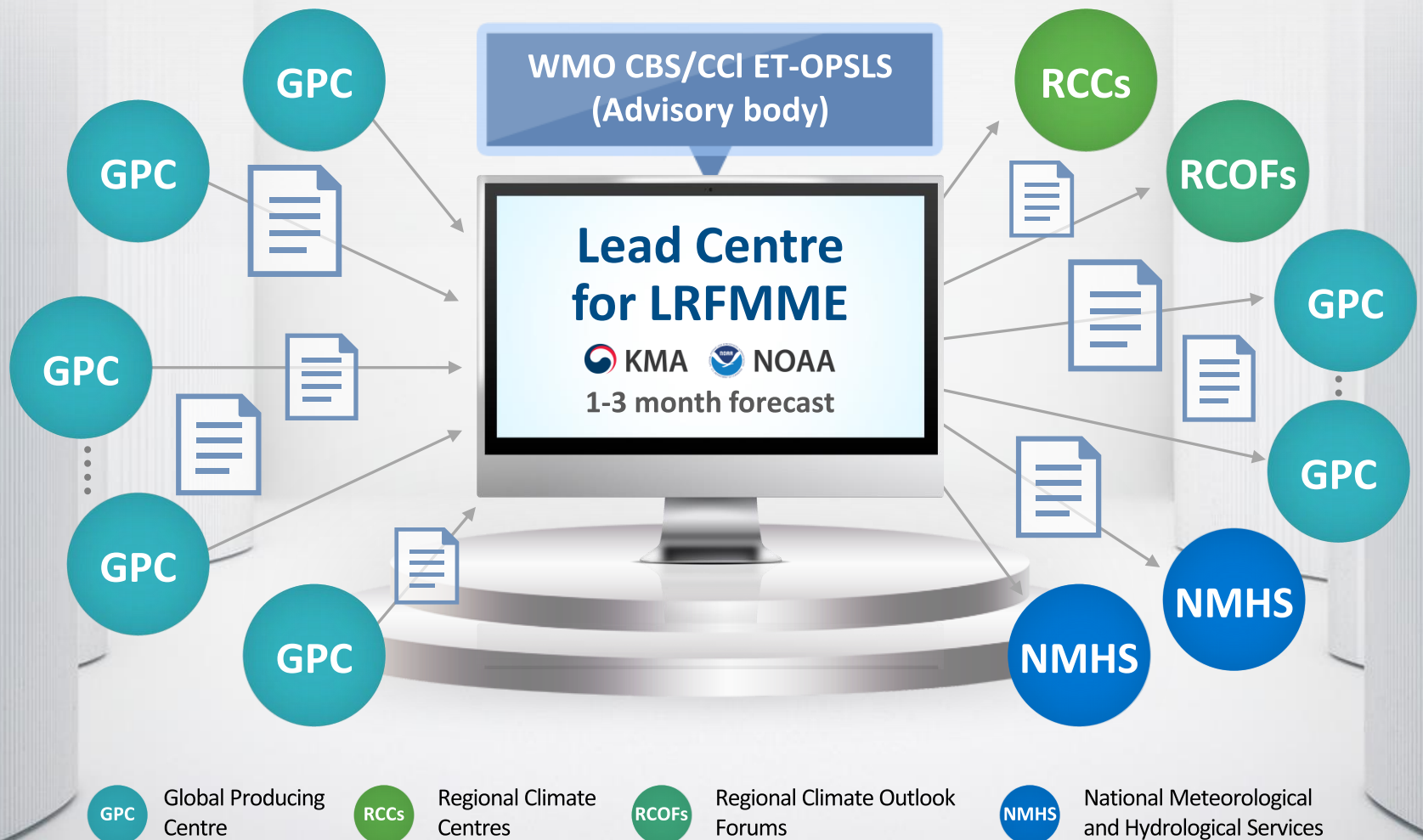


- **Beijing:** China Meteorological Administration (CMA) / Beijing Climate Center (BCC)
- **CPTEC:** Center for Weather Forecasting and Climate Research / National Institute for Space Research (INPE), Brazil
- **ECMWF:** European Centre for Medium-Range Weather Forecasts
- **Exeter:** Met Office, United Kingdom
- **Melbourne:** Bureau of Meteorology (BOM), Australia
- **Montreal:** Meteorological Service of Canada (MSC)
- **Moscow:** Hydrometeorological Centre of Russia
- **Pretoria:** South African Weather Services (SAWS)
- **Seoul:** Korea Meteorological Administration (KMA)
- **Tokyo:** Japan Meteorological Agency (JMA) / Tokyo Climate Center (TCC)
- **Toulouse:** Météo-France
- **Washington:** Climate Prediction Center (CPC) / National Oceanic and Atmospheric Administration (NOAA), United States of America



Functions

LC-LRFMME provides a conduit between GPC and NMHS, RCC, RCOF, etc.



Functions

LC-LRFMME provides a conduit between GPC and NMHS, RCC, RCOF, etc.



Summary of data provided by the GPCs

Information on the data configuration supplied by the 12GPCs

GPC	Beijing	CPTEC	ECMWF	Exeter	Melbourne	Montreal	Moscow	Pretoria	Seoul	Tokyo	Toulouse	Washington
Forecast system	1-tier (coupled)	2-tier	1-tier (coupled)	1-tier (coupled)	1-tier (coupled)	1-tier (coupled)	2-tier	1-tier (coupled)	1-tier (coupled)	1-tier (coupled)	1-tier (coupled)	1-tier (coupled)
Forecast												
Ensemble size	24	15	41	42	33	20	10	40	42	51	41	40
Hindcast												
Period	1991-2010	1979-2010	1981-2010	1993-2015	1981-2011	1981-2010	1981-2010	1982-2009	1991-2010	1979-2014	1991-2014	1983-2010
Ensemble size	24	15	41	42	33	20	10	40	42	51	41	40
Digital data	⊙	⊙	✗	✗	⊙	⊙	⊙	⊙	⊙	✗	✗	⊙

An “✗” indicates that data is not currently available in LC-LRFMME, because of GPC’s data Policy



Products

Digital products

Both forecast and hindcast of monthly mean anomalies of the GPCs' ensemble mean for lead time of 1~3 month, following the month of submission.

- 2m surface temperature
- Precipitation
- Mean sea level pressure
- 850hPa temperature
- 500hPa geopotential height
- Sea surface temperature



Graphical products

Individual forecast

- Plots for each GPCs' forecast anomalies in common graphical format (Rectangular, Time series, Stereographic type, etc.)
- Consistency map
- SST Plume (Nino3.4 SST anomalies)

Deterministic MME

- Simple composite mean(SCM)
- Regular Multiple Regression
- Singular Value Decomposition(SVD)
- Genetic Algorithm(AG)

Probabilistic MME

- Tercile-based categorical probabilities

Verification

- Hindcast for both MME and Individual GPCs
- Forecast for MME



Further plan

About the Sub-Seasonal Multi-Model Ensemble

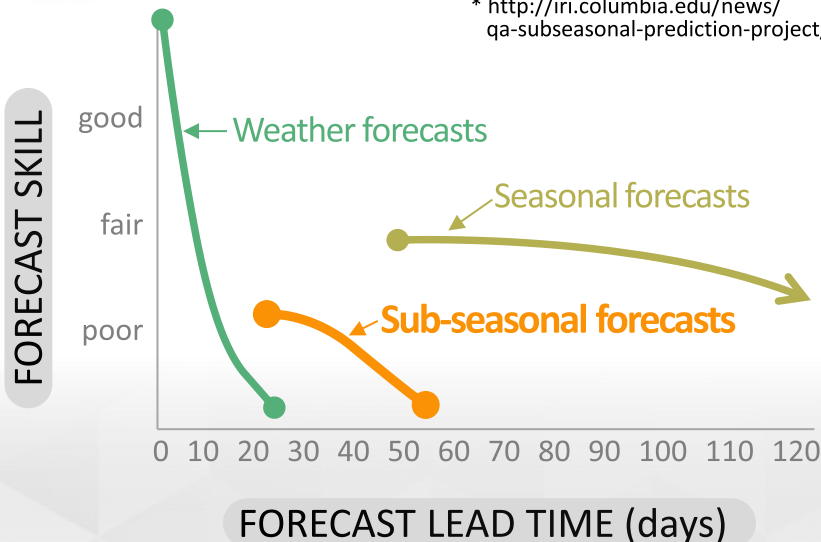
Sub-Seasonal time scale

2 weeks ~2 months

Sub-seasonal to Seasonal Prediction Research Implementation Plan (Dec2013, WMO)

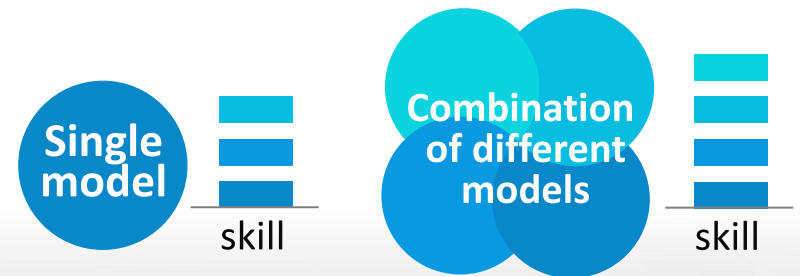
Considered as
A “predictability desert”

* <http://iri.columbia.edu/news/qa-subseasonal-prediction-project/>



Larger ensemble
can give higher skill

Technical challenge in Sub-seasonal MME



Further plan

Pilot real-time MME service for sub-seasonal forecasts

- WMO Cg-XVI(2011) requested LC-LRFMME to expand its role to include exchange of extended-range predictions.
- In the meeting of the S2S steering group (2014), it was agreed to make use of the S2S research archive of sub-seasonal forecasts to develop a real-time multi-model display at the LC-LRFMME.

* S2S : Sub-seasonal to Seasonal Prediction Project



Further plan

Pilot real-time MME service for sub-seasonal forecasts

- The LC-LRFMME is planning to provide MME forecasts and its verification results through website after ET-OPSLS and GPCs agree

✦ **ET-OPSLS** : Expert Team on Operational Predictions from Sub-seasonal to Longer-time Scales.

Products/variables	Covering periods	Charts	Verification scores
<ul style="list-style-type: none"> • Accumulated prec • Average 2m temp 	Weeks 1,2,3,4, 3-4,1-4	Probabilistic maps · terciles	Reliability diagrams / ROC
MJO Need: <ul style="list-style-type: none"> • OLR • U850 • U200 	32 days	<ul style="list-style-type: none"> • Hendon and Wheeler Diagram • Hovmoller 	Temporal correlation and RMSE
Velocity Potential	Weeks 1,2,3,4, 3-4,1-4	Velocity potential anomaly (Ensemble mean for each period)	correlation



How to register on the WMO LC-LRFMME

<http://www.wmolc.org>

WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble

Home About us News Data & Plot Related Sites LC-LRCMME tabs WMO Lead Centre for SVSLRF

Introduction | Deterministic MME | Probabilistic MME | References

Latest Forecast data Latest Forecast data

Latest PMME plot Latest Individual Forecast plot

Notice / News Notice and News

WMO Global Producing Centres Global Producing Centres

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[Login](#) [Sign Up](#)

- **Sign up:** You can register on the website after signing up.
- **Login:** You can log in to LC-LRFMME homepage by clicking this button and entering your ID and password.

For more information in detail

Please see the
WMO LC-LRFMME Website
User Manual in
Notice and News



How to register on the WMO LC-LRFMME

Key Information

Agreement

Step 1 To register with the website, click on the “Sign Up” button. Then fill out your basic information.

Step 2 Please read the Terms of Service, Privacy Handling Policy, and Agreement, and check each box “I agree” to confirm that you agree with the terms. Then click “Make a New Account.”

Step 3 After signing up, click on a hyperlink “[LINK]” in your email message that you filled in the “Sign up” page.

Step 4 At this link page, you will get authentication after entering logging in with your ID, password.

Step 5 The administrator will give you a **membership grade**, such as grade A, B or C, depending on your affiliation.

» Membership Grade		A (GPCs)	B (NMHSs and RCCs)	C (Others)
Digital data	Upload	⊙		
	Download	⊙	⊙	
Image plots	Upload			
	Download	⊙	⊙	
Multi-model ensemble image plots				⊙



<http://www.wmolc.org>



For more Information,
Please contact !




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Korea Meteorological
Administration

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Supplementary Information





**WMO Lead Centre for
Long-Range Forecast Multi-Model Ensemble**

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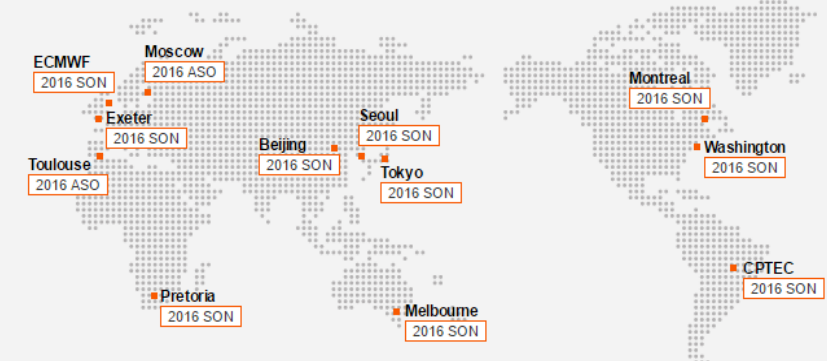
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[Related Sites](#)

DATA & Plot

[WMO Lead Centre for SVSLRF >>](#)

[Introduction](#) | [Deterministic MME](#) | [Probabilistic MME](#) | [References](#)

Latest Forecast data



Latest PMME plot

[View all >](#)

Latest Individual Forecast plot


Notice / News

- 🔴 **Check!** System Requirements
 User guide of the LC-LRFMME website is published! new 2016.08.19
- New leaflet of LC-LRFMME is published! new 2016.08.17
- All GPCs(12) for ASO 2016 are uploaded 2016.08.01
- GPCs(11) for JAS 2016 are uploaded 2016.08.01
- All GPCs(12) for JJA 2016 are uploaded 2016.08.01


User guide

Leaflet


**LC-LRCMME
Global Producing Centres**




Canada




Montreal




BCC Beijing




ECMWF




MOSMOS




Moscow




Seoul




Tokyo




Toulouse




Washington




Exeter




PCMAA Melbourne



Pretoria




CPTEC



Korea Meteorological
Administration

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today : 85 total : 168932



Products

1. Digital products

This screenshot shows the 'Data & Plot' menu with the following options:

- Data Exchange Policy**
- Data Exchange**
 - Search/Download
 - Direct Download
 - Upload
- Plot**
 - Probabilistic Multi-Model Ensemble
 - Deterministic Multi-Model Ensemble
 - Individual Forecast
 - Energetics
 - Indices
 - Verification : Hindcast
 - Verification : Forecast
 - 6 month MME
- System Configuration Information**

This screenshot shows the 'Search/Download' interface for the SCM model. The search criteria are:

- Model: SCM
- Casttype: forecast
- Start Year: 2016
- End Year: 2016
- Month: MAM
- Parameter: All

The search results table is as follows:

<input type="checkbox"/>	No	Model	Casttype	Start	End	Month	Filename
<input type="checkbox"/>	4863	SCM	forecast	2016	2016	MAM	scm_201602_201603_201605.grb1_TMP850_mb.grb2
<input type="checkbox"/>	4863	SCM	forecast	2016	2016	MAM	scm_201602_201603_201605.grb1_PRMSLMSL.grb2
<input type="checkbox"/>	4863	SCM	forecast	2016	2016	MAM	scm_201602_201603_201605.grb1_APCP0_m_above_gnd.grb2
<input type="checkbox"/>	4863	SCM	forecast	2016	2016	MAM	scm_201602_201603_201605.grb1_TMP2_m_above_gnd.grb2
<input type="checkbox"/>	4863	SCM	forecast	2016	2016	MAM	scm_201602_201603_201605.grb1_TMPsfc.grb2
<input type="checkbox"/>	4863	SCM	forecast	2016	2016	MAM	scm_201602_201603_201605.grb1_HGT500_mb.grb2

A 'Download' button is located at the bottom right of the table.

This screenshot shows the 'Search/Download' interface for the Beijing model. The search criteria are:

- Model: Beijing
- Casttype: forecast

The search results table is as follows:

<input type="checkbox"/>	No	Model	Casttype	Start	End	Month	Filename
<input type="checkbox"/>	4901	Beijing	forecast	2016	2016	JJA	beijing_201605_201606_201608.grb1_APCP0_m_above_gnd.grb2
<input type="checkbox"/>	4901	Beijing	forecast	2016	2016	JJA	beijing_201605_201606_201608.grb1_TMP2_m_above_gnd.grb2
<input type="checkbox"/>	4901	Beijing	forecast	2016	2016	JJA	beijing_201605_201606_201608.grb1_TMPsfc.grb2
<input type="checkbox"/>	4901	Beijing	forecast	2016	2016	JJA	beijing_201605_201606_201608.grb1_HGT500_mb.grb2
<input type="checkbox"/>	4901	Beijing	forecast	2016	2016	JJA	beijing_201605_201606_201608.grb1_TMP850_mb.grb2

A 'Download' button is located at the bottom right of the table.



Products

2. Individual Forecast

WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble

Home About us News **Data & Plot** Related Sites

Data Exchange Policy | Data Exchange | **Plot** | System Configuration Information

Home > Data & Plot > Individual Forecast

Data & Plot

Data Exchange Policy

Data Exchange

- Search/Download
- Direct Download
- Upload

Plot

- Probabilistic Multi-Model Ensemble
- Deterministic Multi-Model Ensemble
- Individual Forecast
- Energetics
- Indices
- Verification : Hindcast
- Verification : Forecast
- 6 month MME

System Configuration Information

Individual Forecast

Display

Map Type

Rectangular Time series Stereographic All Map Consistency Map SSST Plume

Select Period

Forecast: 2016 [ASO] [Mean] ex) 2008 SON
 Hindcast: [] ~ [] [None] ex) 1983 ~ 2000 DJF

Select Model

Beijing CPTEC ECMWF Exeter Melbourne Montreal Moscow
 Pretoria Seoul Tokyo Toulouse Washington

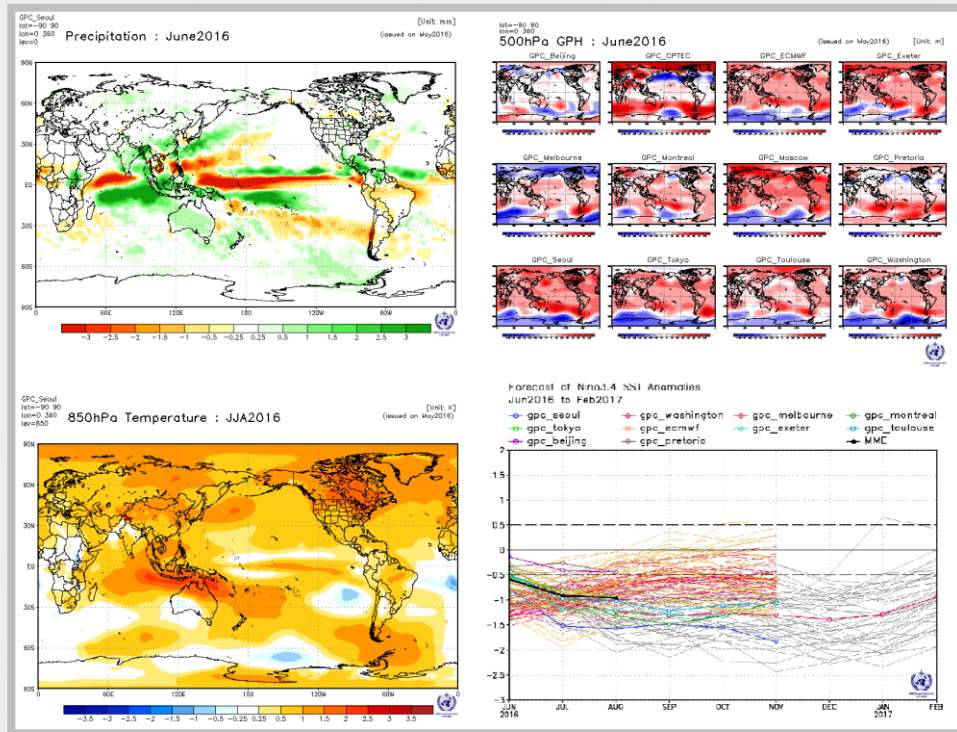
Select Region

Global [] Longitude [0] ~ [360] , Latitude [-90] ~ [90]

Select Parameters

Precipitation 500hPa GPH Mean Sea Level Pressure 2m Temperature
 850hPa Temperature Sea Surface Temperature

Plot



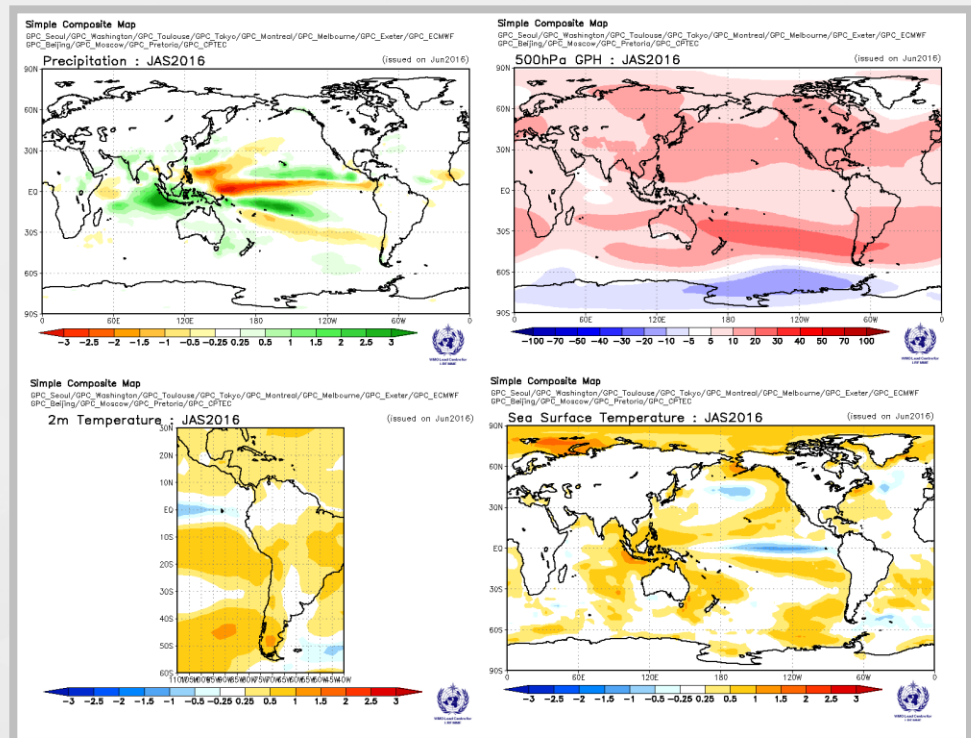
Products

3. Deterministic Multi-Model Ensemble (DMME)

- Simple Composite Map(SCM)
- Regular Multiple Regression(RMR)
- Singular Value Decomposition(SVD)
- Genetic Algorithm(GA)

SCM

The screenshot shows the WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble website. The main navigation bar includes 'Home', 'About us', 'News', 'Data & Plot', and 'Related Sites'. The 'Data & Plot' section is active, displaying 'Deterministic Multi-Model Ensemble'. Under 'Data Exchange Policy', there are options for 'Simple Ensemble Mean', 'Regular Multiple Regression', 'Singular Value Decomposition (SVD)', and 'Genetic Algorithm (GA)'. The 'Plot' section includes options for 'Definition', 'Display', 'Select Period' (Issued date: 2016 OCT, Period: 2016 NOV ~ 2017 APR), 'Select Model' (Seoul, Washington, Toulouse, Montreal, Melbourne, ECHWF, Beijing, CPTC), 'Select Parameters' (All, Precipitation, 500hPa GPH, Mean Sea Level Pressure, 2m Temperature, 850hPa Temperature, Sea Surface Temperature), and 'Select Region' (Global, Longitude: 0 ~ 360, Latitude: -90 ~ 90). A 'Plot' button is at the bottom.



Products

4. Probabilistic Multi-Model Ensemble (PMME)

WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble

Home About us News **Data & Plot** Subseasonal Related Sites

Data Exchange Policy | Data Exchange | **Plot** | System Configuration Information

Home > Data & Plot > Probabilistic Multi-Model Ensemble

Data & Plot

- Data Exchange Policy
- Data Exchange
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 - Direct Download
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Probabilistic Multi-Model Ensemble

Definition
 Display

Map Type

Combined Below Normal Near Normal Above Normal

Select Period

Forecast 2016 ASO Mean ex) 2008 SON

Select Model

All melbourne moscow montreal cptec ecmwf tokyo pretoria washington seoul exeter beijing

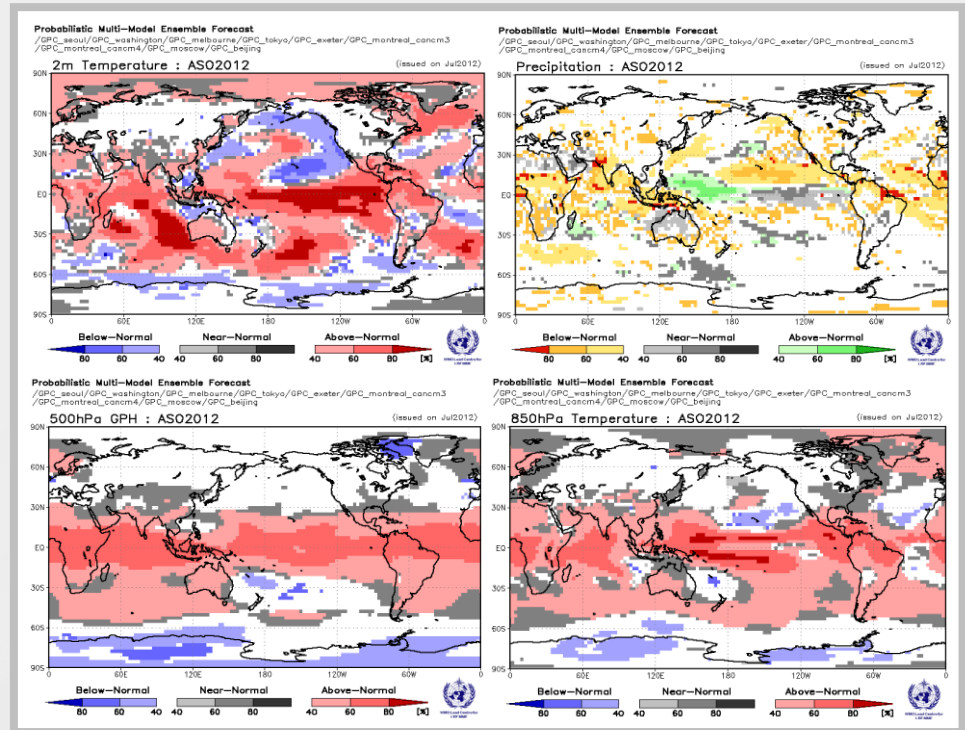
Select Parameters

Precipitation 500hPa GPH Mean Sea Level Pressure
 2m Temperature 850hPa Temperature

Select Region

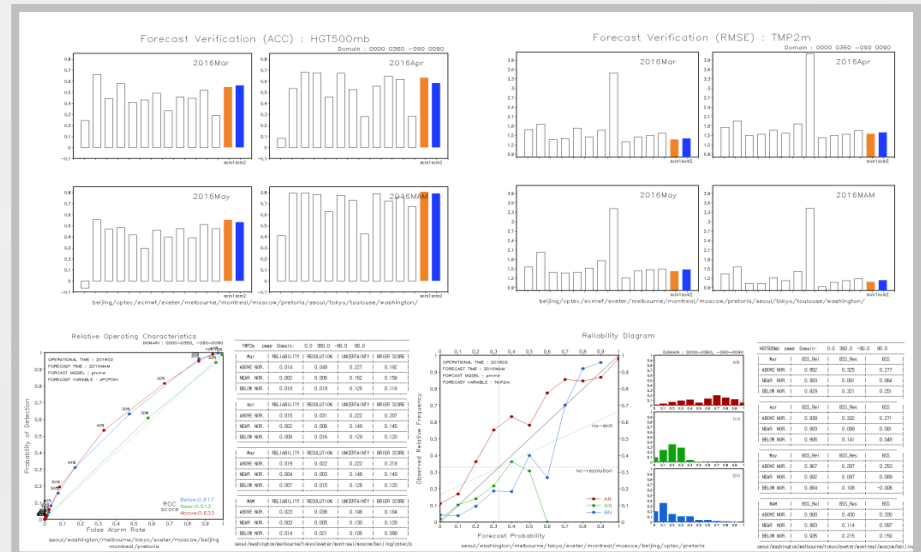
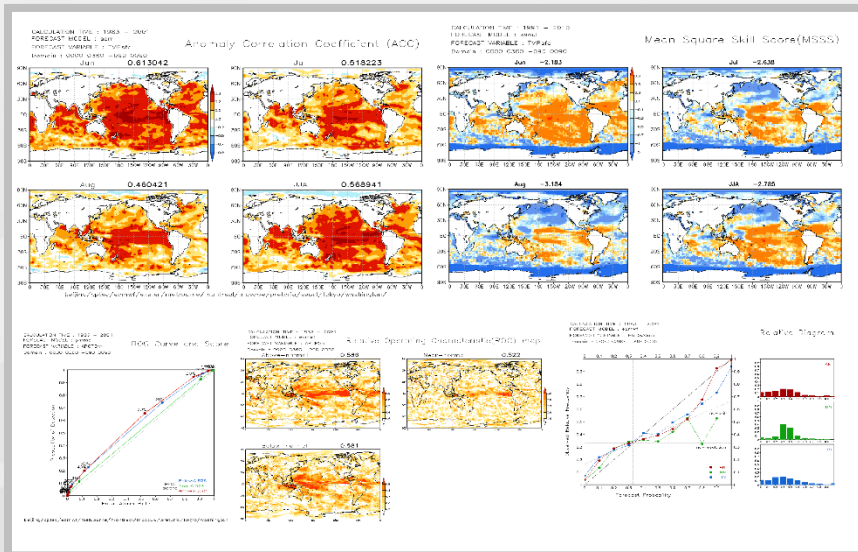
Global Longitude 0 ~ 360 Latitude -90 ~ 90

Plot



5. Verifications

- The calculating and displaying function for verification of individual GPC hindcast data in LC-LRFMME web site is available.
- The standard verification system for long-range forecast (SVSLRF) diagnostics are calculated with same verification dataset and reference baseline for the GSCU.
- Verification products with common reference periods (1993-2009, 17years) from submission month of Sep2016





Survey for User Services

How to register on the WMO LC-LRFMME

<http://www.wmolc.org>

WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble

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Introduction | Deterministic MME | Probabilistic MME | References

Latest Forecast data Latest Forecast data

Latest PMME plot Latest Individual Forecast plot

Notice / News Notice and News

Notice / News	Date
Check! System Requirements	
User guide of the LC-LRFMME website is published!	2016.08.19
New leaflet of LC-LRFMME is published!	2016.08.17
All GPCs(12) for ASO 2016 are uploaded	2016.08.01
GPCs(11) for JAS 2016 are uploaded	2016.07.05
All GPCs(12) for JJA 2016 are uploaded	2016.05.26

WMO Global Producing Centres Global Producing Centres

Canada Montreal BCC Beijing ECMWF International Centre of Russia Moscow

Seoul Tokyo Toulouse Washington

Exeter PCMA Melbourne Pretoria CPTC

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- Precipitation
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Probabilistic MME

- Tercile-based categorical probabilities

Verification

- Hindcast for both MME and Individual GPCs
- Forecast for MME



Survey for User Services

WMO Lead Centre for
2016 Survey for satisfaction measurement (during Sept.-Nov. 2016)

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Thank you for using our WMO LC-LRFMME website. The LC-LRFMME is jointly organized and operated by the Korea Meteorological Administration (KMA) and NOAA/NCEP. It provides high-quality climate prediction products and develops advanced climate prediction technology, which is contributing to the reduction of the adverse impacts of abnormal climate. As a part of our ongoing efforts to provide better services, we are conducting a simple survey on our website. In this regard, we would appreciate it if you can take a few moments to fill in the survey form below.

* is a required input.

1. Which organisation do you belong to/which organisation are you involved in? (select all that match) *
The maximum number of choices is 4.

WMO Global Producing Centres (GPCs) for Long Range Forecasts (LRF)
 National Hydrological and Meteorological Services (NHMS)
 WMO Regional Climate Centre (RCC)
 Regional Climate Outlook Forum (RCOF)
 Other :

2. How often do you visit the WMO LC-LRFMME homepage? *
 more than 12 times a year (at least once a month)
 4~12 times (at least once a season)
 1~3 times (at least once a year)
 once in a while

3. What is your major purpose of using the forecast information from WMO LC-LRFMME? *

Korea Meteorological Administration | Email: ic_lrfmme@korea.kr | Tel: 82-2-2181-0474 Fax: 82-2-2181-0489
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Sep. 2016 ~ Nov. 2016

After login,
You can Participate in the survey.



Thank you



Climate Prediction Division
Korea Meteorological
Administration