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

2005 Oct

» WMO GPC meeting
(October, Korea)

KMA suggested the need of LC-LRFMME

2006 Apr

» Expert Team on LRF
(April, England)

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

Nov

» WMO CBS-Ext.06
(November, Korea)

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

2007 Jun

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

History

2009 — Apr

» WMO CBS-XIV
(April, Croatia)

LC-LRFMME was officially endorsed

2011 — Apr — May

» WMO Cg-XVI
(May, Switzerland)

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

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

2016 — Present

» **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

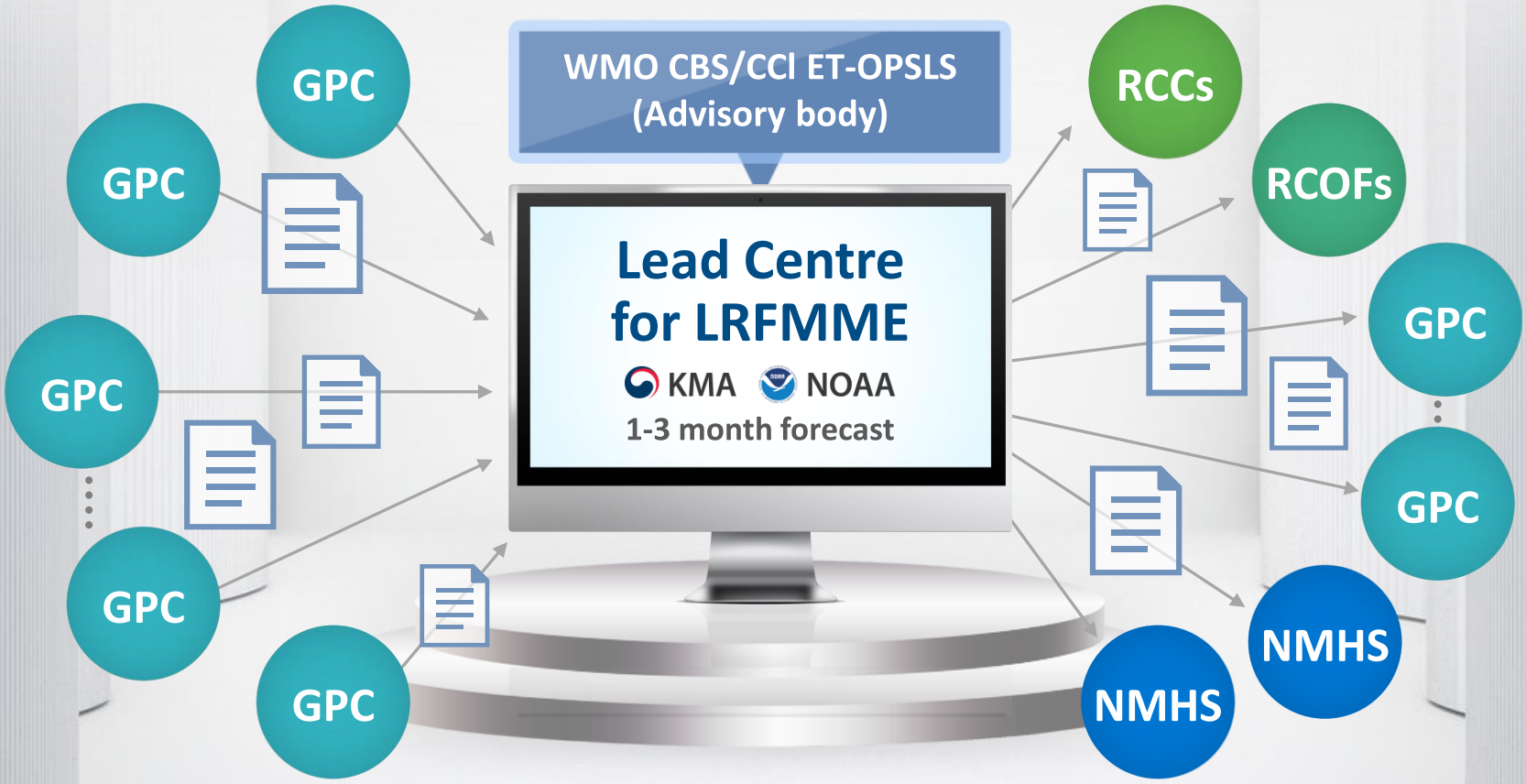
12 WMO GPCs for LRF

WMO Global Producing Centres

- **Beijing:** China Meteorological Administration (CMA) / Bejing 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.



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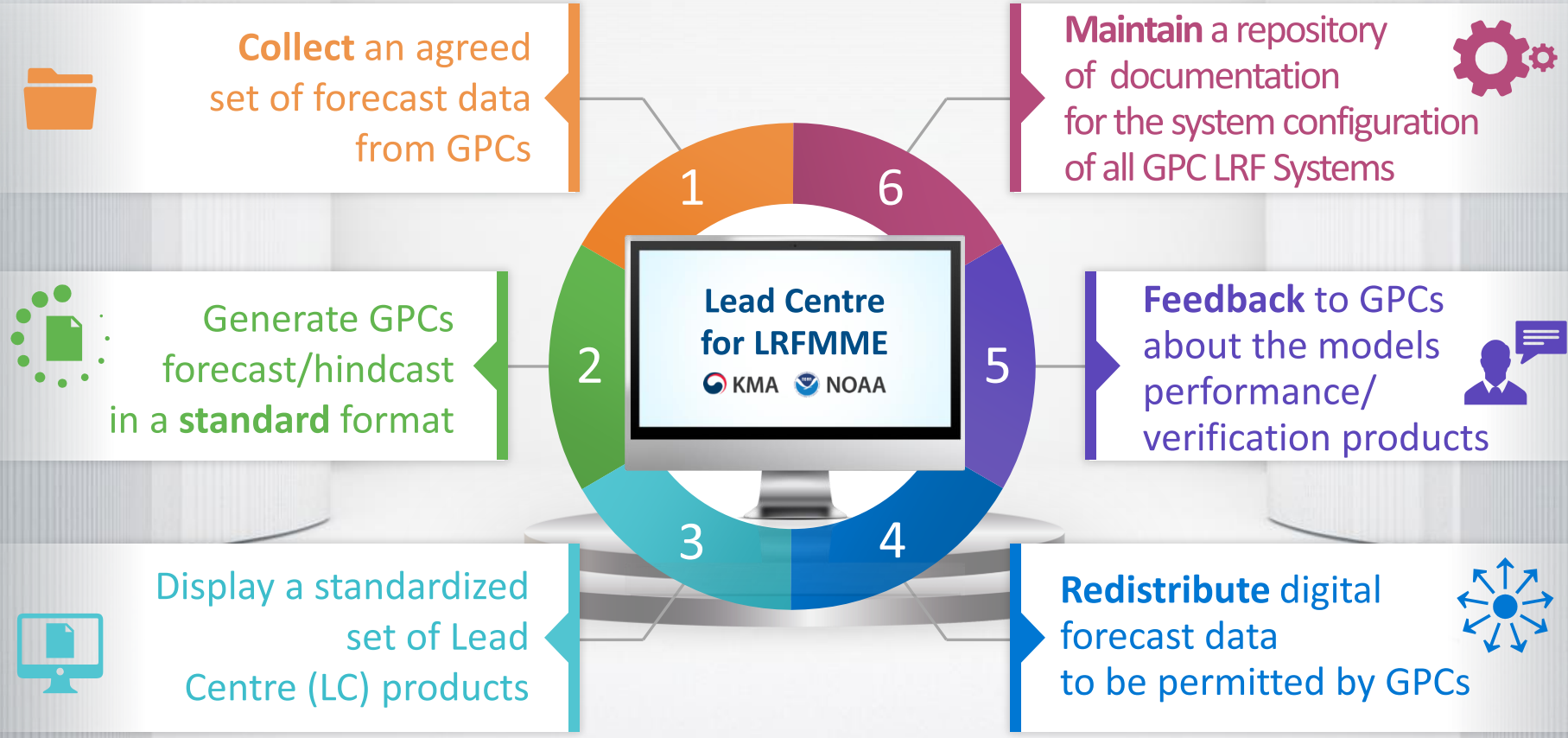


Summary of data provided by the GPCs

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
- Sigular 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

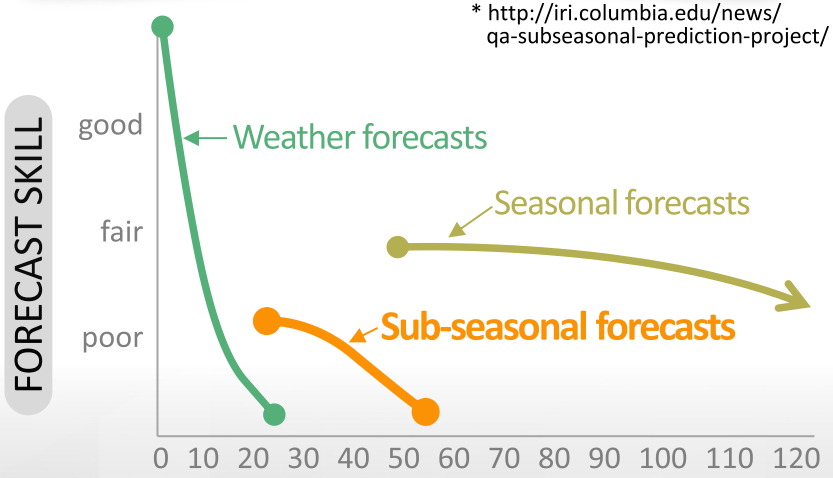
Sub-Seasonal time scale

2 weeks ~2 months

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

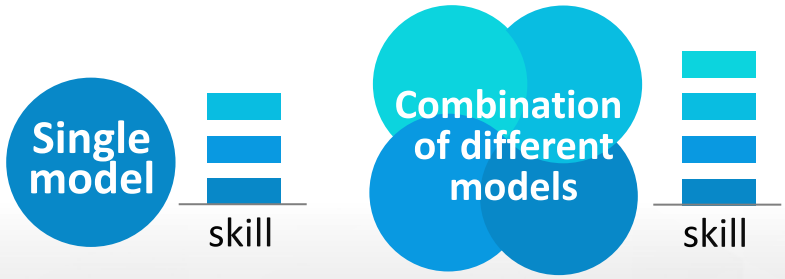
Considered as A "predictability desert"

* 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

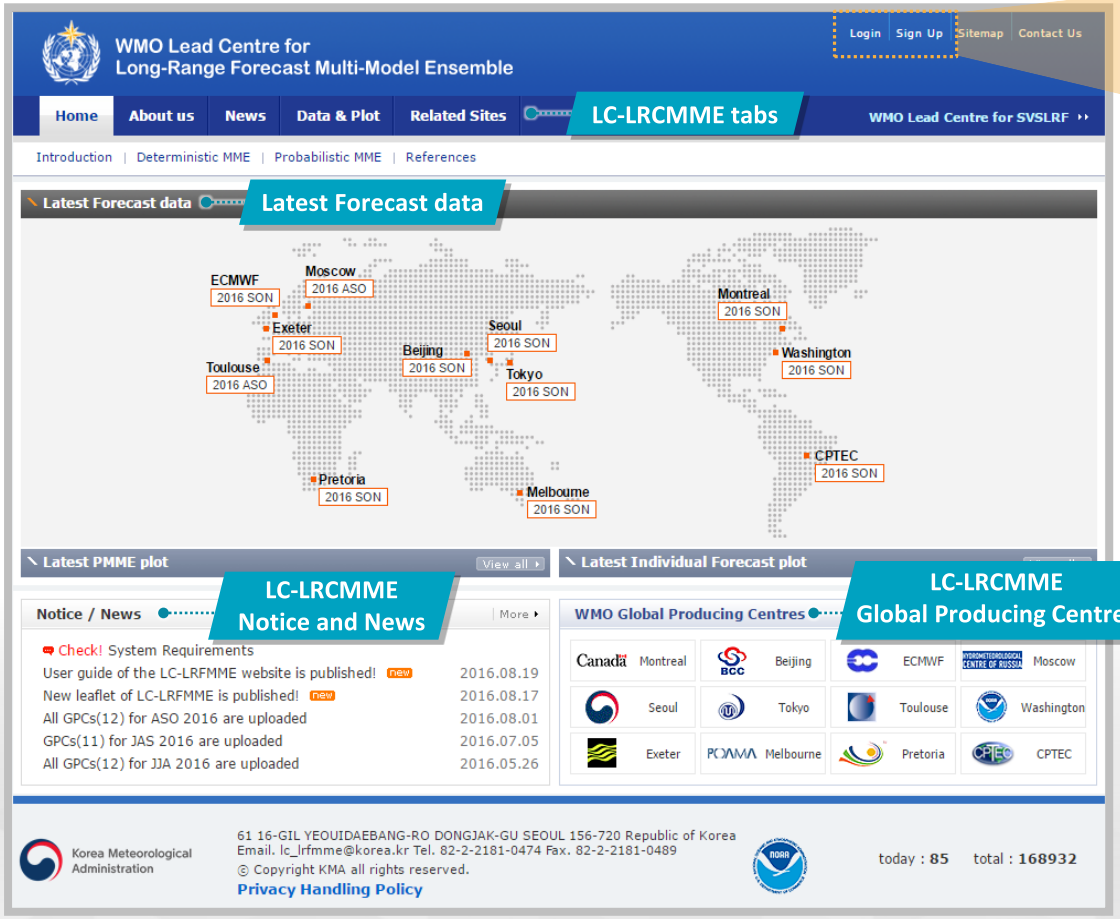
- The LC-LRFMME is planning to provide MME forecasts and its verification results through website after ET-OPSLS and GPCs agree

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

Products/variables	Covering periods	Charts	Verification scores
· Accumulated prec **· Average 2m temp**	Weeks 1,2,3,4, 3-4,1-4	Probabilistic maps · terciles	Reliability diagrams / ROC
MJO Need: **· OLR** **· U850** **· U200**	32 days	· 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



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For more information in detail

Please see the
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User Manual in
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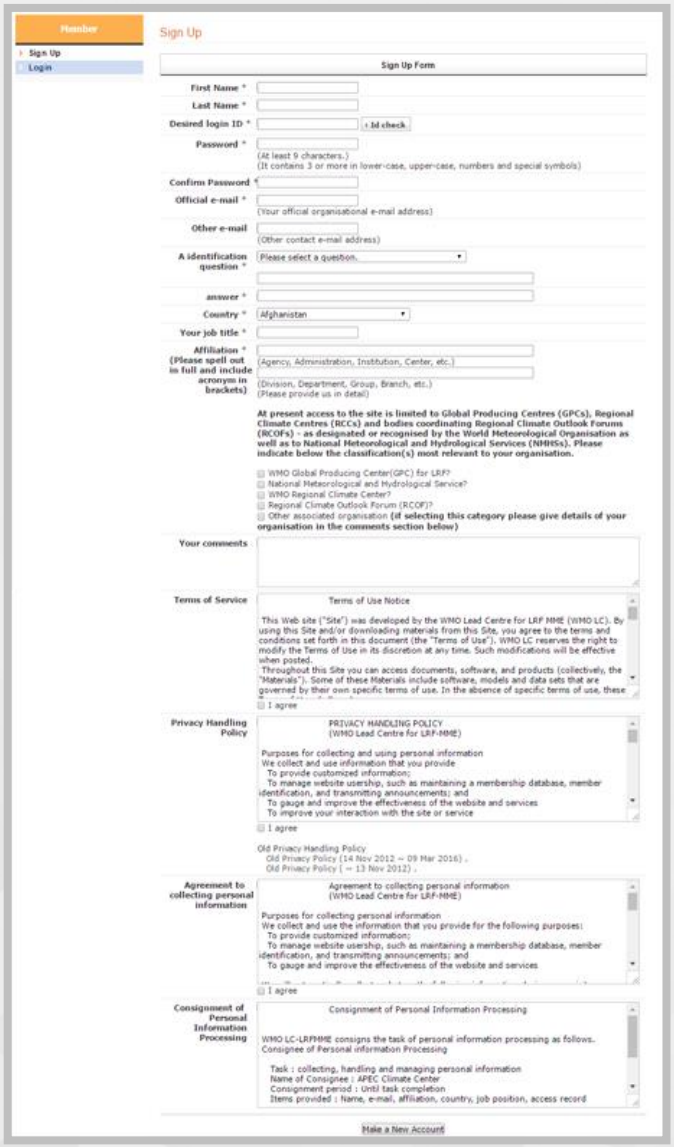
How to register on the WMO LC-LRFMME

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 !

Climate Prediction Division
Korea Meteorological Administration

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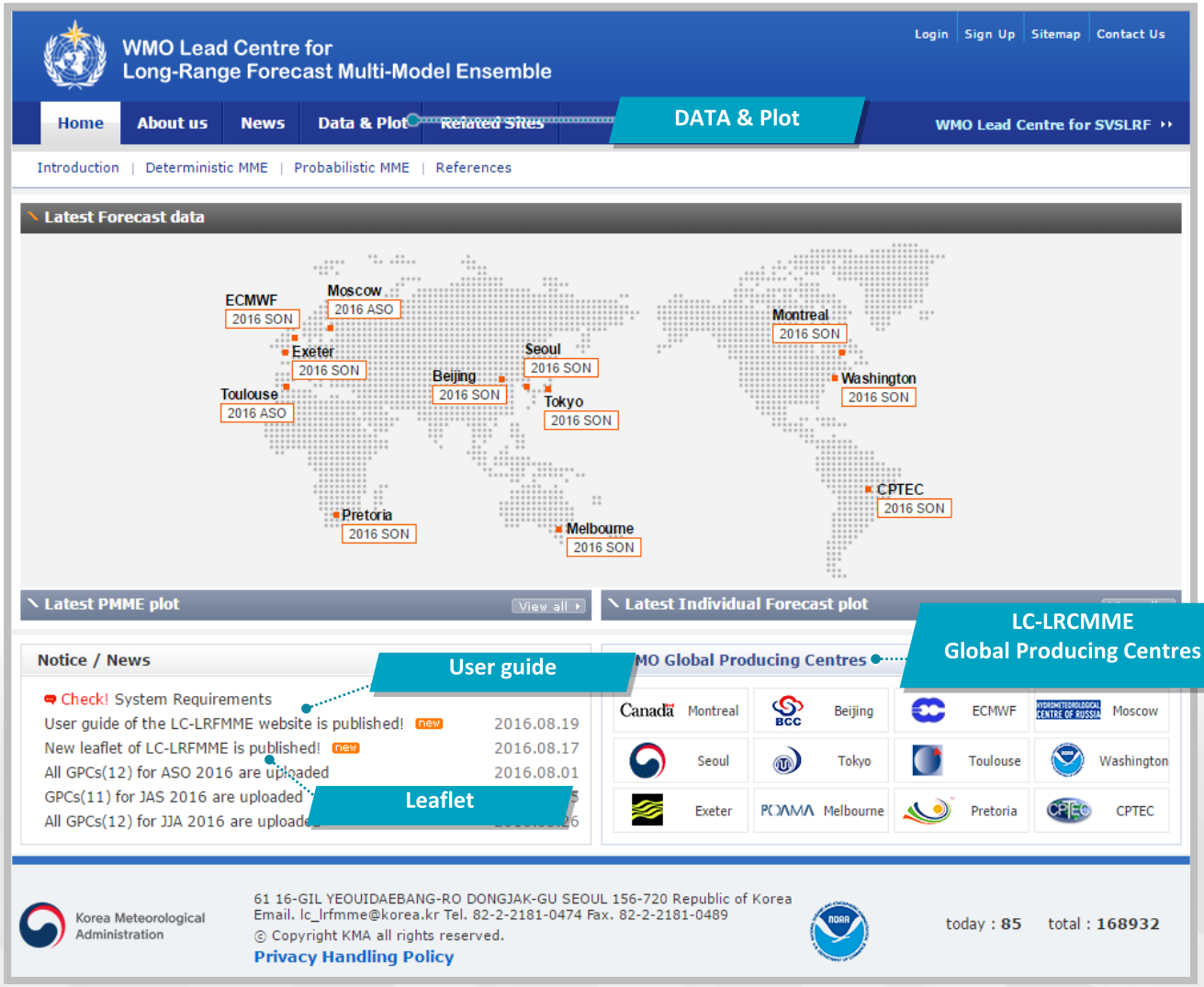
- E-mail : lc_lrfmme@korea.kr

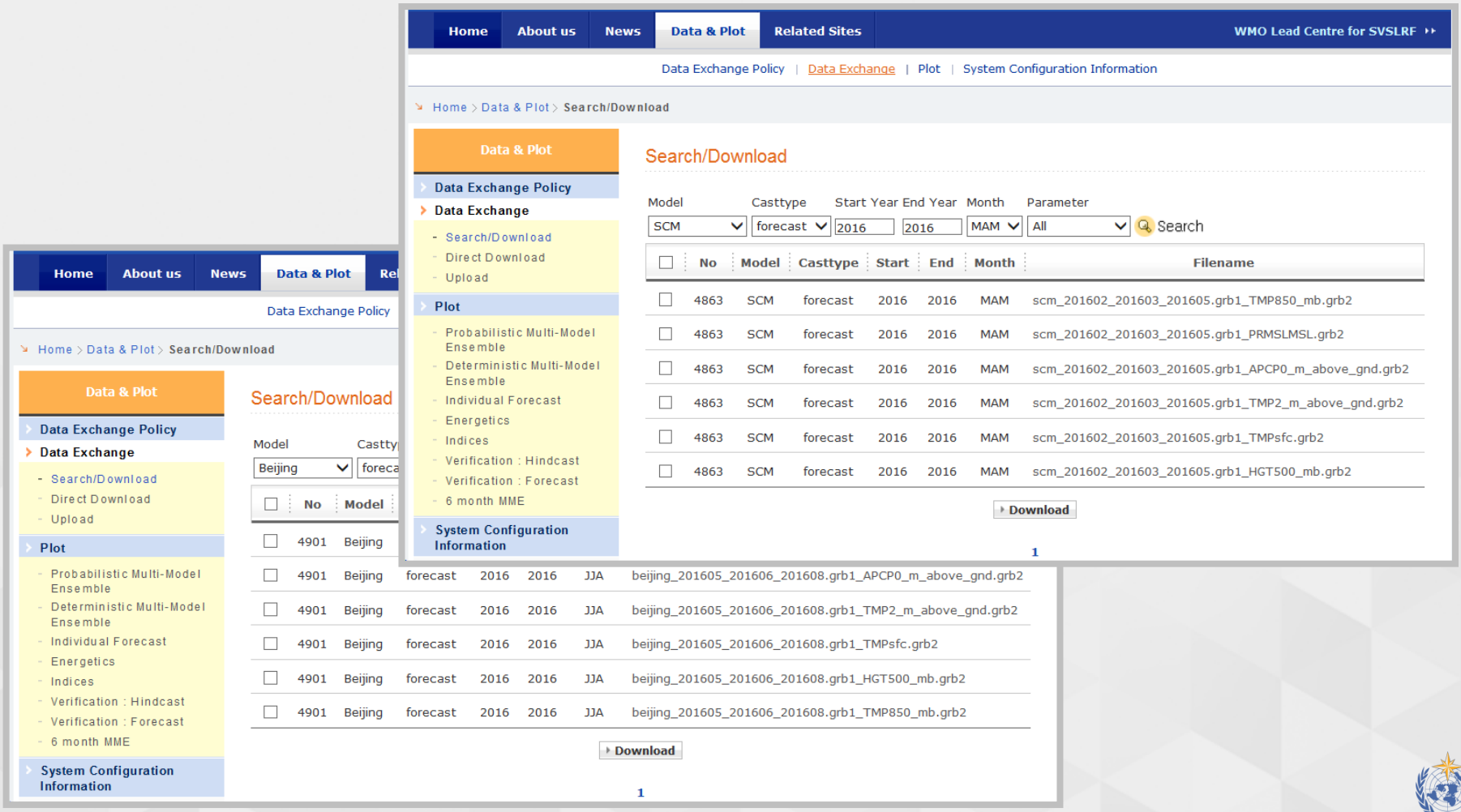
Supplementary Information

http://www.wmolc.org



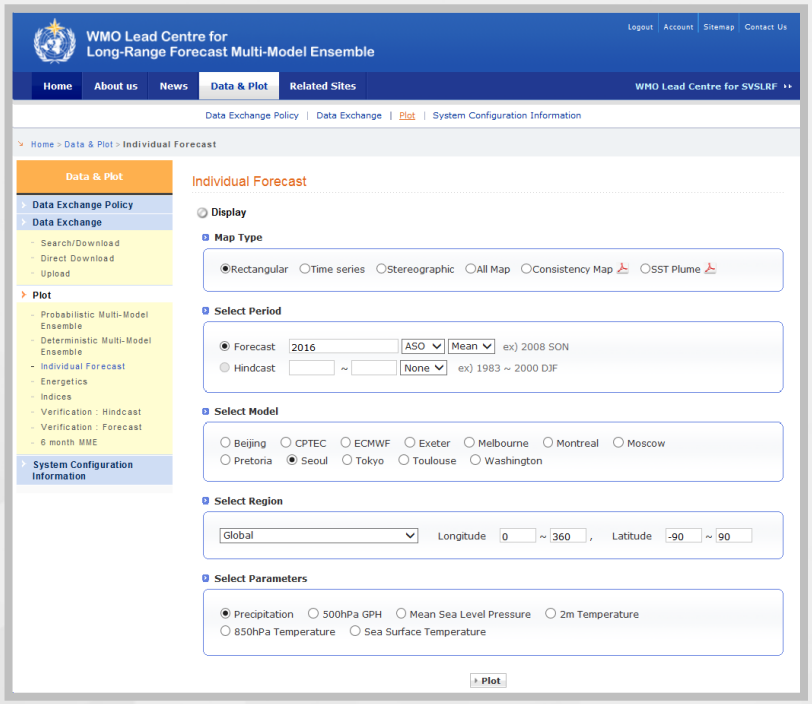
Products

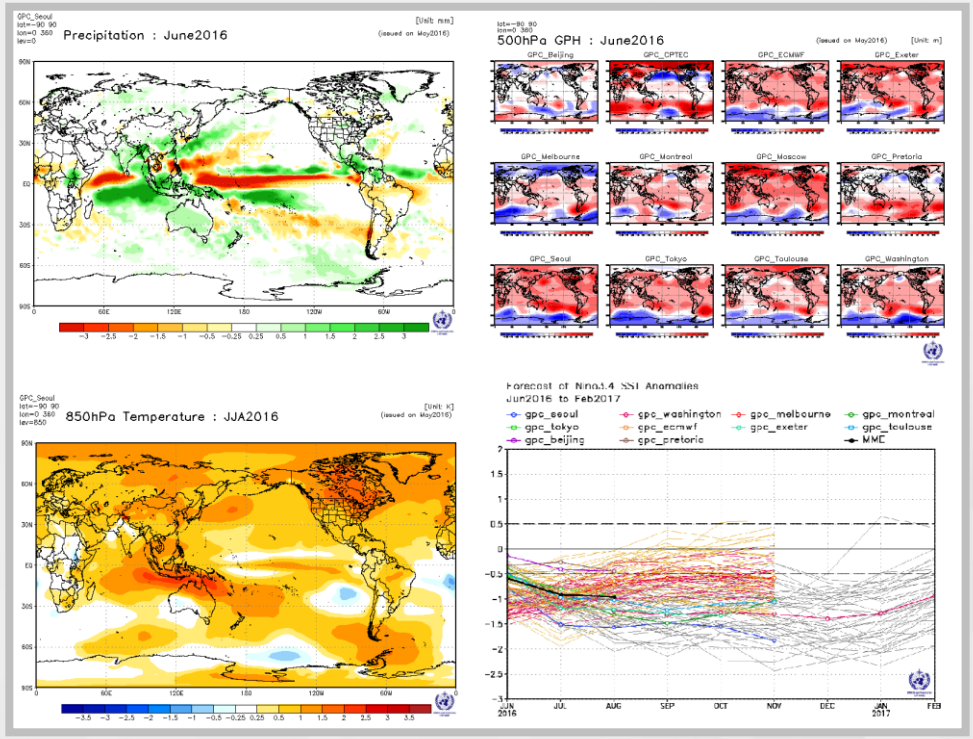
1. Digital products



Products

2. Individual Forecast

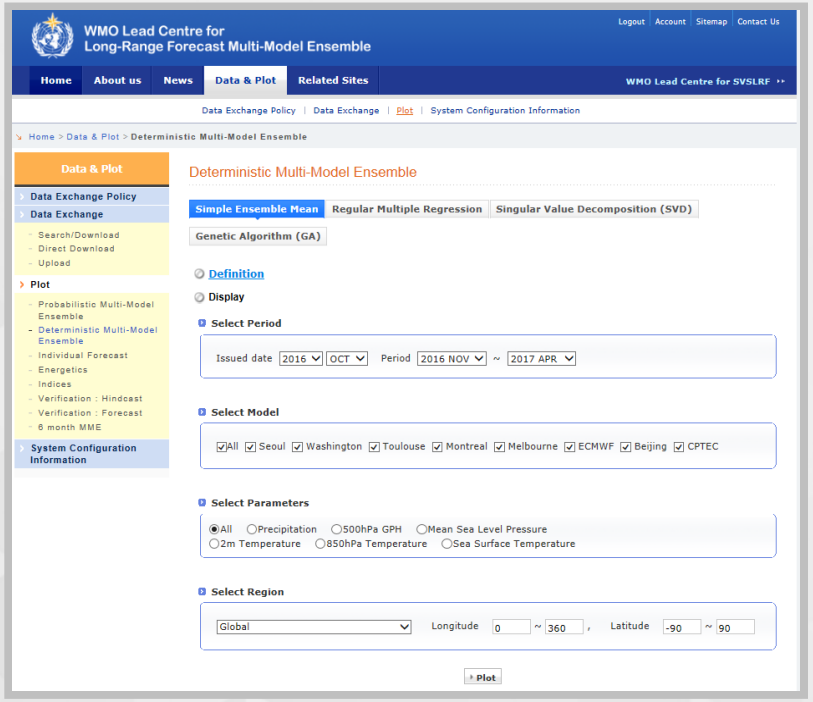




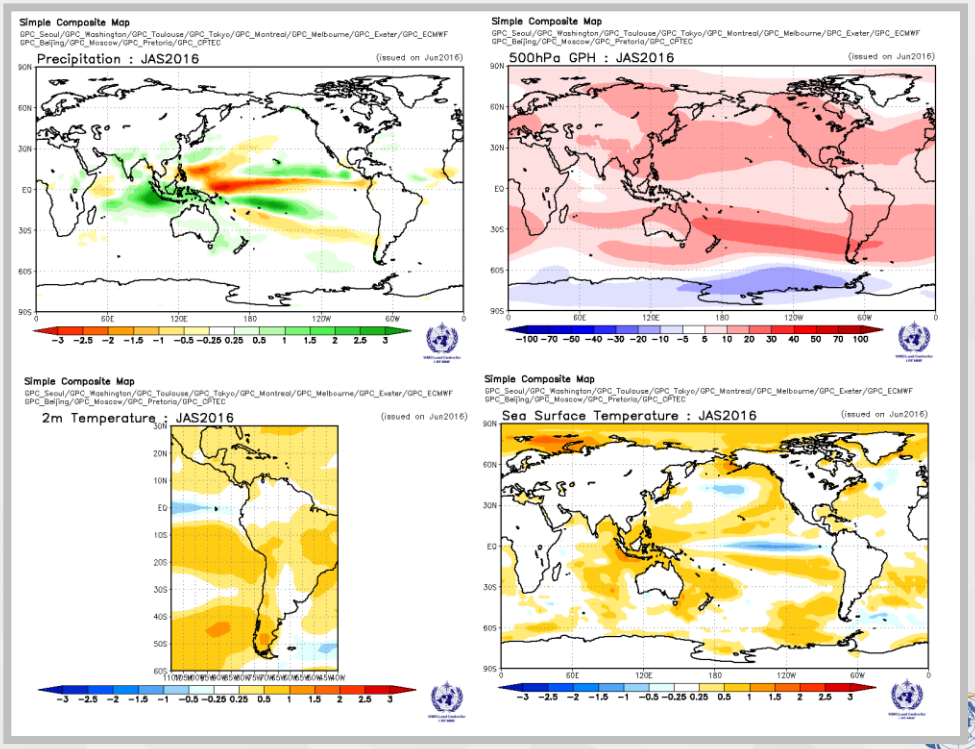
Products

3. Deterministic Multi-Model Ensemble (DMME)

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

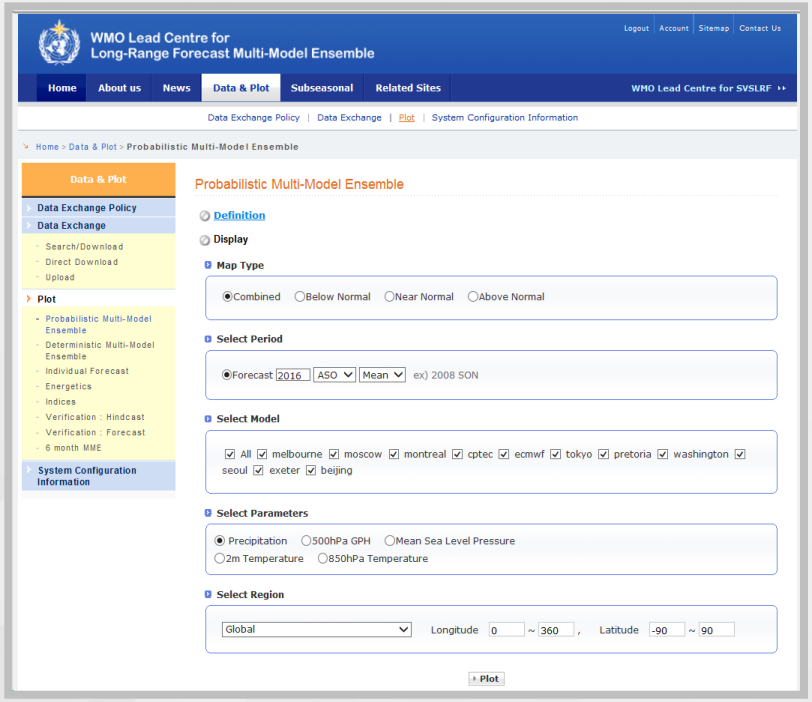


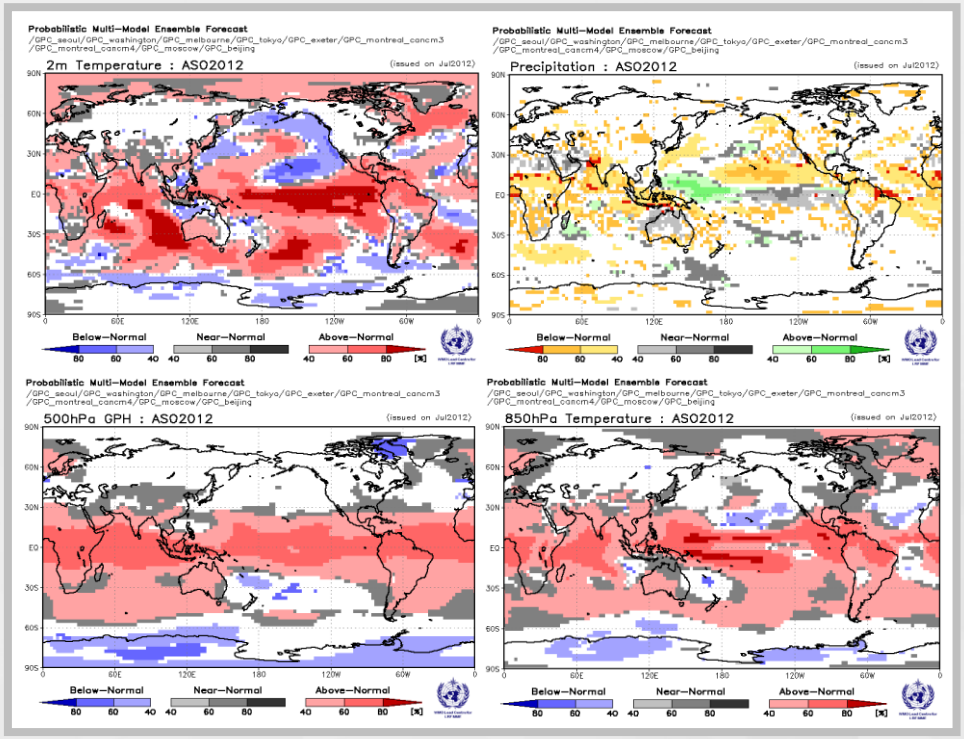
SCM



Products

4. Probabilistic Multi-Model Ensemble (PMME)

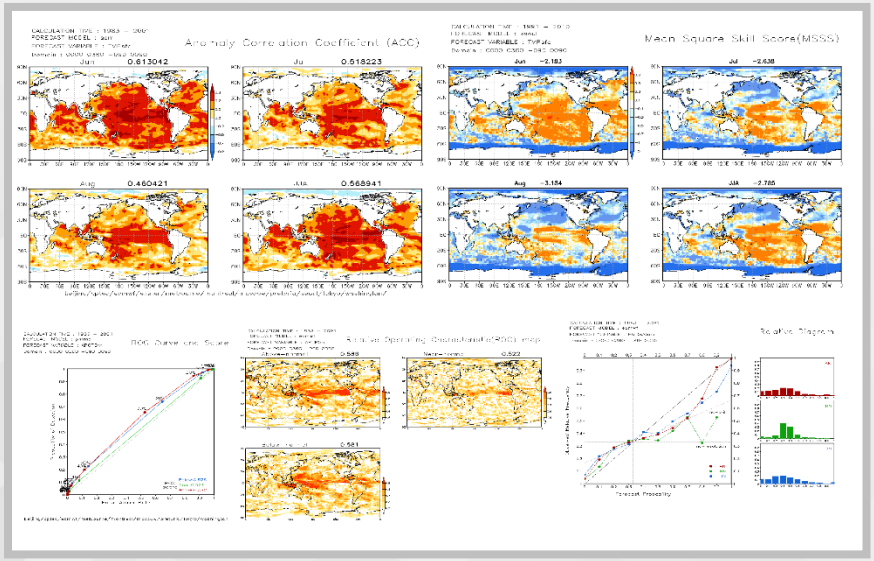


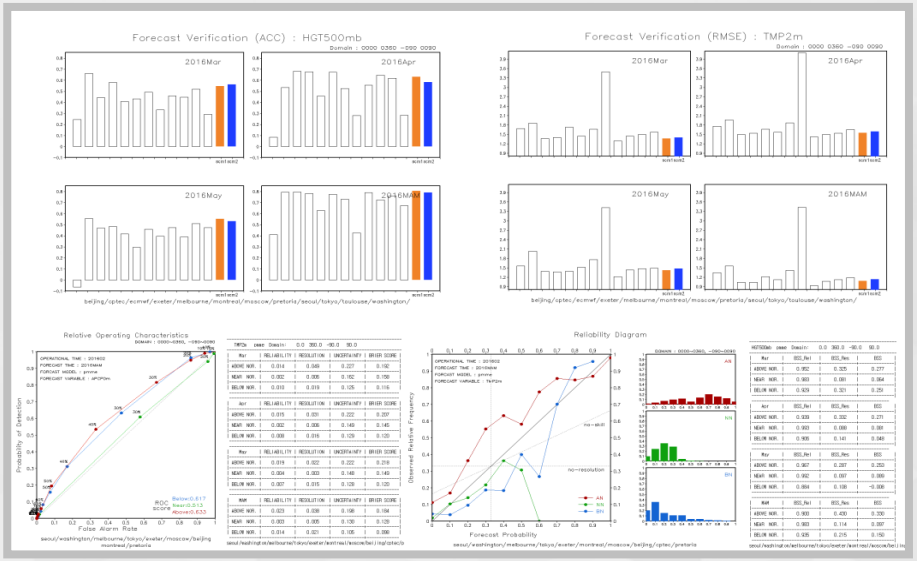


Products

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

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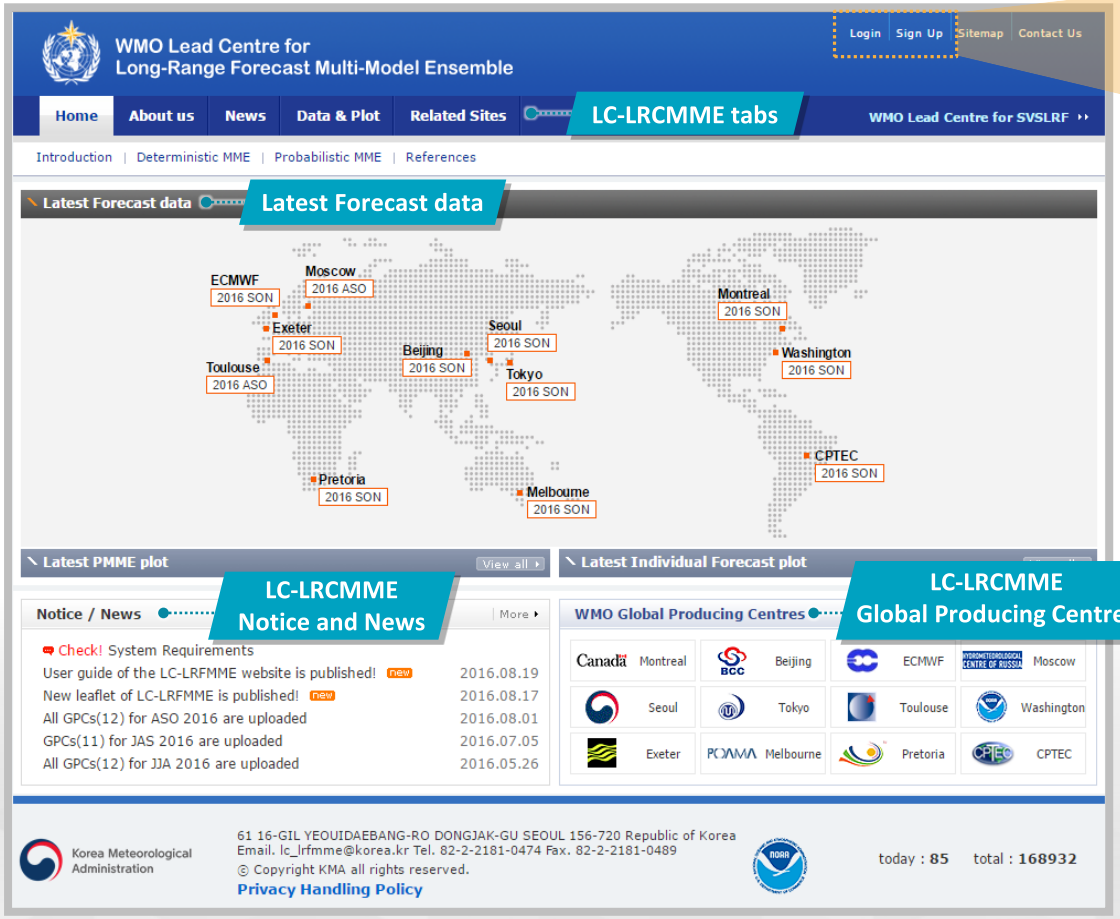

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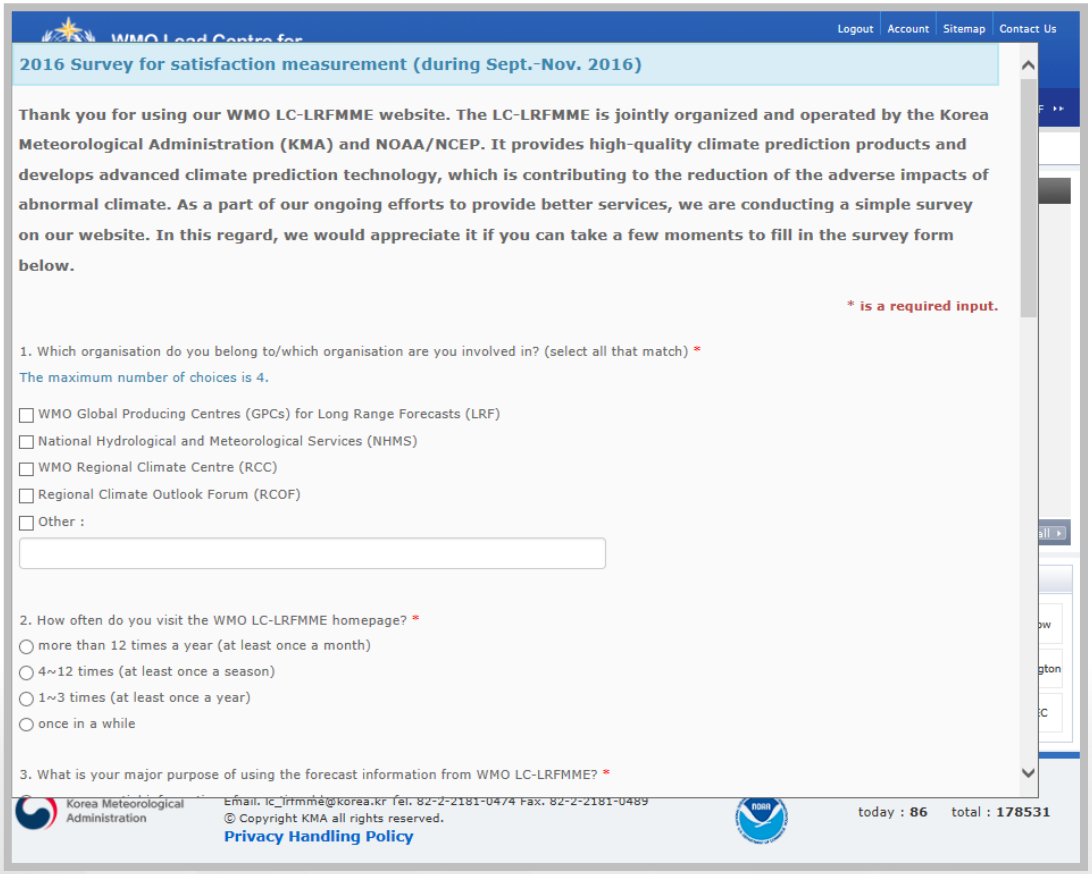

Sep. 2016 ~ Nov. 2016

After login,
You can Participate in the survey.

Thank you

Climate Prediction Division
Korea Meteorological
Administration