# GPC-LRFs, RCCs and their role in RCOF operations: *Current status and future prospects*

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**Plan of talk**

- **Introductory background information**
- **WMO infrastructure for seasonal and inter-annual prediction**
- **Global Producing Centres for Long-Range Forecasts (GPC-LRFs) products**
- **WMO LC-LRFMME and LC-SVSLRF functions/activities**
- **Regional Climate Centres (RCC) functions**
- **Current roles of GPC-LRFs and RCCs in RCOFs**
- **Current status and future prospects for improving RCOF practices**

WMO Workshop on Global Review of Regional Climate Outlook Forums
*Guayaquil, Ecuador, 5-7 September 2017*

# Background

- In recent years WMO (through CBS and CCl) designated centres responsible for generating and delivering long-range forecasts and other climate information
- This infrastructure is part of the Global Data-Processing and Forecast System (GDPFS)
- It is also the core for the Climate Service Information System (CSIS) of the Global Framework for Climate Services (GFCS)
- The designated centres and their roles and responsibilities are defined in the Manual on the GDPFS (WMO-No. 485)

# WMO infrastructure for seasonal and inter-annual prediction

- GFCS three-tier structure: global, regional and national
  For long-range forecasting:

*Global domain:*

- Global Producing Centres for Long-Range Forecasts (GPC-LRFs) responsible for producing and disseminating long-range forecasts and associated verification with global coverage;
- A Lead Centre (LC) for Long-Range Forecast Multi-Model Ensembles (LC-LRFMME): responsible for collecting GPC forecasts, displaying the forecast information, generating multi-model products, and more recently generating verification information for GPC-LRFs delegating score computation to the LC
- A Lead Centre for Standardised Verification of Long-Range Forecasts (LC-SVSLRF): responsible for providing documentation on verification scores, software and datasets for long-range forecast verification

*Regional domain:*

- Regional Climate Centres (RCCs) and RCC Networks covering WMO RAs and Polar Regions are either fully desig. or in demons. phase

*National domain:*

- National Met. and Hydrol. Serv. (NMHSs) play central role at national level, including coord. National Climate Outlook Forums (NCOFs)

# Designation of Global Producing Centres of LRF

- WMO process to designate centres making global seasonal forecasts as WMO Global Producing Centres (GPCs) of Long Range Forecasts (LRF) started in 2006
- GPCs follow commonly defined standards – aiding consistency and usability of output:
  - a fixed forecast production cycle
  - a standard set of forecast products
  - WMO-defined verification standards for retrospective forecasts (set of measures described in the WMO Standard Verification System for Long-Range Forecasts – SVSLRF)

# Currently designated GPC-LRF

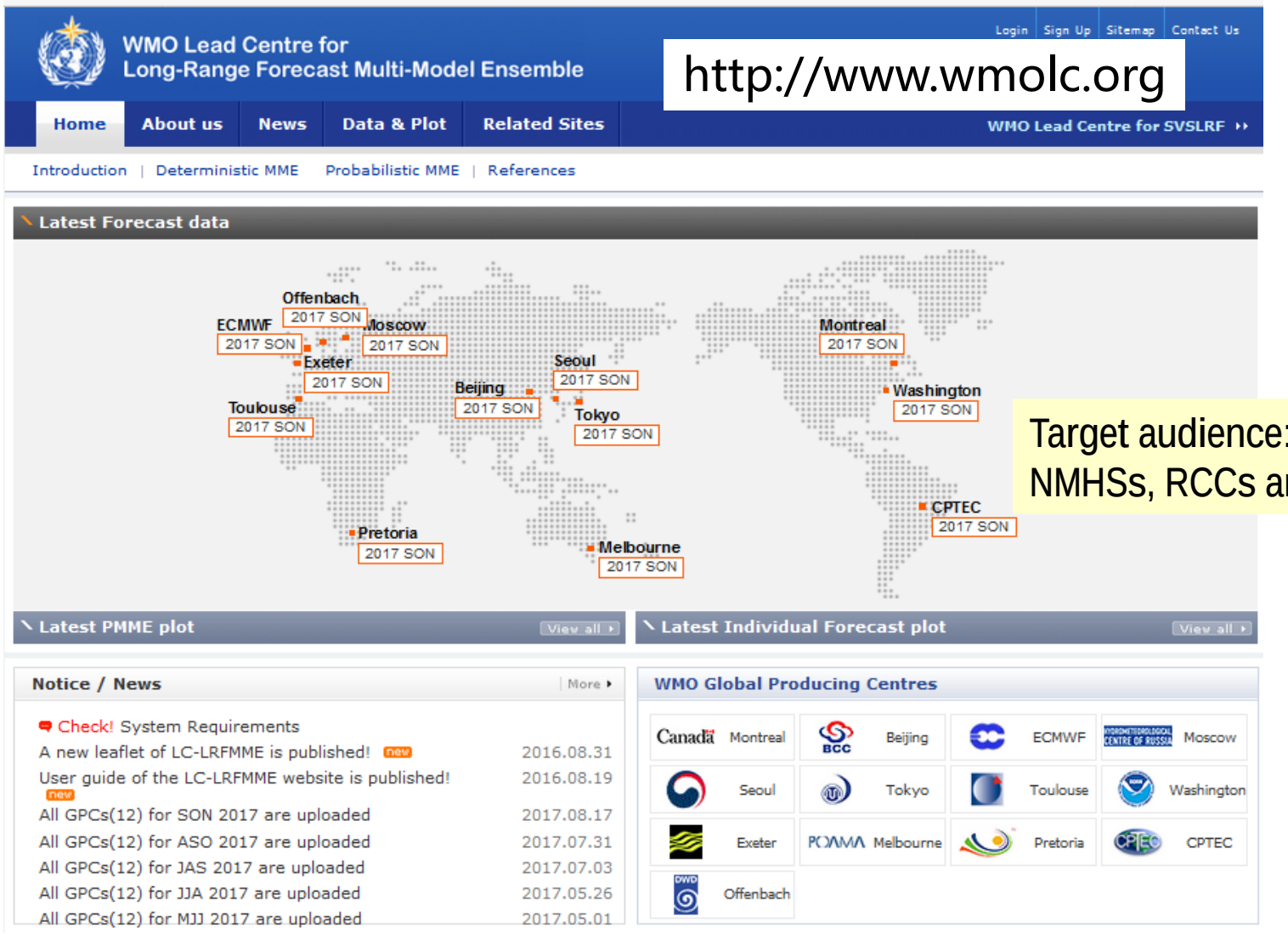

Links to 13 designated GPCs: **Target audience: NMHSs, RCCs and RCOFs**

http://www.wmo.int/pages/prog/wcp/wcasp/gpc/gpc.php

# Minimum required products delivered by GPC-LRF

- Predictions for averages, accumulations, or frequencies over 1-month periods or longer (typically anomalies in 3-month-averaged quantities is the standard format for seasonal forecasts, and forecasts are usually expressed probabilistically)
- Lead time: between 0 and 4 months
- Issue frequency: monthly or at least quarterly
- Delivery: graphical images on GPC-LRF website and/or digital data for download
- Variables: 2m temperature, precipitation, Sea Surface Temperature (SST), Mean Sea-Level Pressure (MSLP), 500hPa height, 850hPa temperature
- Long-term forecast skill assessments, using measures defined by the SVSLRF

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




Target audience:
NMHSs, RCCs and RCOFs

Jointly operated by Korean Meteorological Administration (KMA) and NOAA NCEP

# LC-LRFMME operational activities on LRF in support of WMO members

- Collection of retrospective and real-time forecasts from GPCs
- Production of real time forecast products from the collected GPCs
- More recently, production of verification products from the collected GPCs retrospective forecasts for GPCs that delegate score computation to the LC
- Production of multi-model ensemble (MME) forecast products from the collected GPCs
- More recently, production of verification products for the MME forecast products from the collected GPCs
- Dissemination of all forecast and verification products listed above in the LC-LRFMME web site for NMHSs, RCCs and RCOFs
- Dissemination of retrospective forecast data from GPCs (that allow data distribution) to RCCs, NMHSs and RCOFs
- Production of forecast and verification products for the Global Seasonal Climate Update (GSCU)
- More recently, development of pilot sub-seasonal forecast products

# WMO Lead Centre for Standardised Verification of Long-Range Forecasts

World Meteorological Organization
Lead Centre for the
Long Range Forecast Verification System

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DISCLAIMER

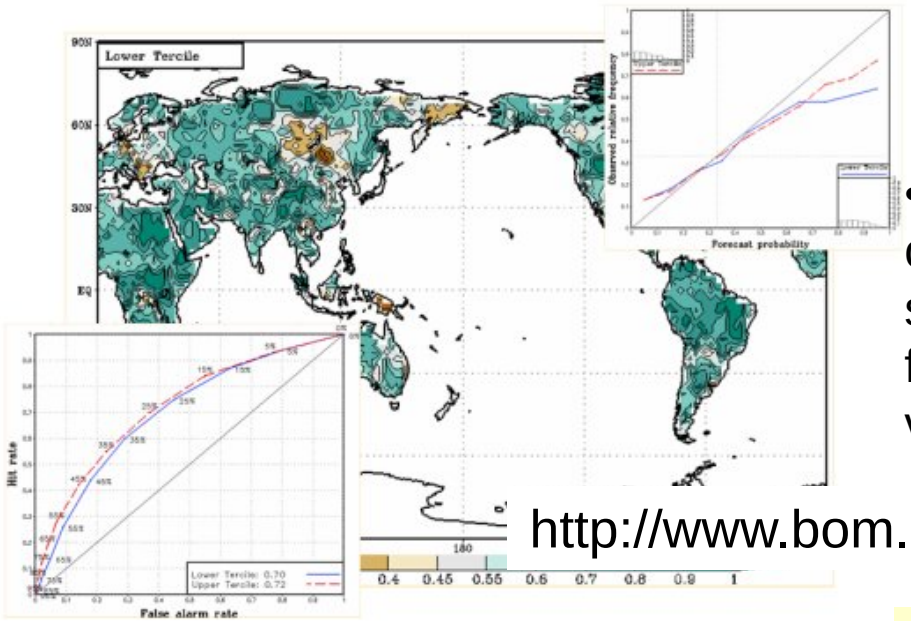
DOCUMENTATION

Participating Met. Agencies.
Lead Centre role.
Documentation and software.
Verifying datasets.
Submitting data.
Glossary.

USERS GUIDE

Variables to be assessed.
Levels of assessment.
Diagnostic measures.
What the Lead Centre provides.
How to submit results.
Format for submitting results.
Model system details.

VERIFICATION MAPS




The Lead Centre provides access to verification datasets, verifying software, documentation of the system, broad technical support, access to the final verification data as well as graphing and display of results.

The WMO Lead Centre for the SVS-LRF is jointly managed by the Australian Bureau of Meteorology and the Meteorological Service of Canada.

Current seasonal forecasts from Global Producing Centre (GPC) models will become available via the Lead Centre for Long-Range Forecast Multi-Model Ensemble Prediction.

- Provide documentation on verification scores, software and datasets for long-range forecast verification

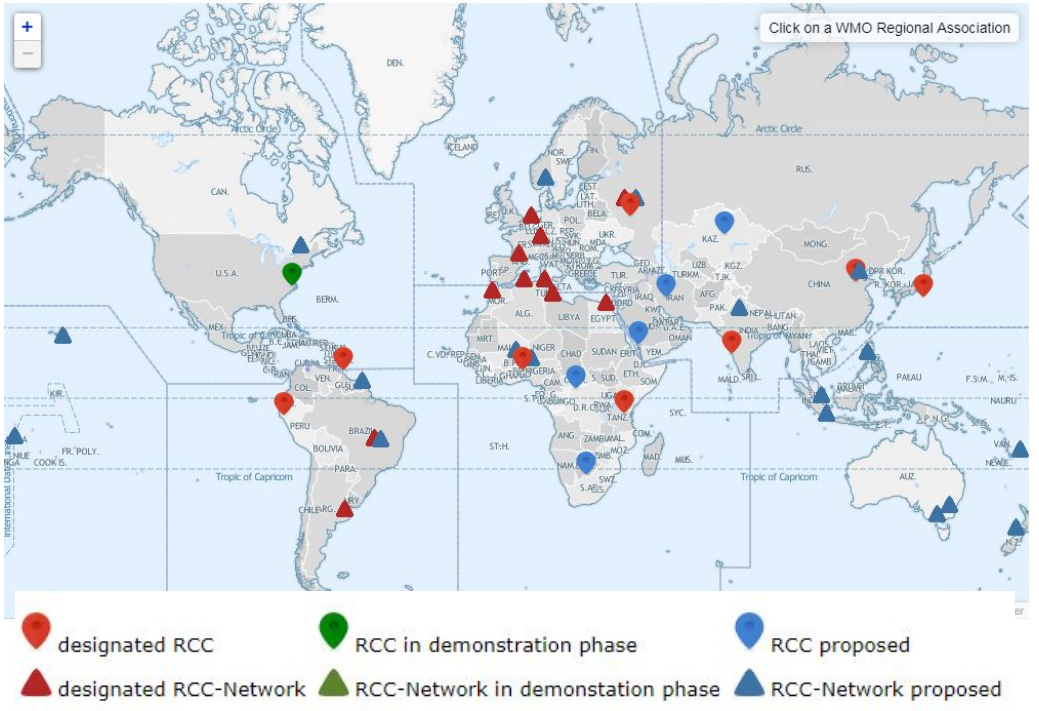
http://www.bom.gov.au/wmo/lrfvs/

Target audience: GPCs, NMHSs, RCCs and RCOFs

Jointly managed by the Australian Bureau of Meteorology (BOM) and the Meteorological Service of Canada

# Regional Climate Centres (RCCs)

- RCCs provide regional climate products in support of regional and national climate activities
- Mandatory Functions:
  - Operational Activities for LRF
  - Operational Activities for Climate Monitoring
  - Operational Data Services, to support operational LRF and climate monitoring
  - Training in the use of operational RCC products and services
- Highly Recommended Functions:
  - Climate prediction and projection
  - Non-operational data services
  - Coordination functions
  - Training and capacity building
  - Research and development
- Two modes of Implementation: fully self-contained RCCs or distributed-function RCC-Networks




- RCOF: good platform for collecting RCCs/RCCs-Network feedback from NMHSs and sector specific users

- ET-RCC recommends to consider including RCC feedback questionnaires in the agenda of RCOFs

http://www.wmo.int/pages/prog/wcp/wcasp/rcc/rcc.php

# Current roles of GPC-LRFs and RCCs in RCOFs

**GPC-LRFs**

- Provision of model data, seasonal forecast and verification products
- Expert assessment/interpretation of seasonal forecast and verification products
- Provision of training for RCOF participants on the use, interpretation and production of seasonal forecast and verification products

**RCCs**

- Provision of observed data, climate monitoring and seasonal forecast products tailored for the region of interest
- Expert assessment/interpretation of climate monitoring products relevant for the region of interest
- Expert assessment/interpretation of seasonal forecast and verification products for the region of interest
- Provision of training for RCOF participants on the use and interpretation of seasonal forecast and verification products for the region of interest

# Current status and future prospects for improving RCOF practices

• Data and products generated by GPC-LRFs and disseminated either directly by GPC-LRFs or via the WMO LC-LRFMME are well structured and managed under guidance of the joint CBS/CCl IPET-OPSLS

• Target audience: NMHSs, RCCs and RCOFs

**Collaborative effort btw GPC-LRFs, RCCs and NMHSs is key for the success and further improving RCOF practices**

• Currently available forecast and verification products (maps) disseminated either directly by GPC-LRFs or via the LC-LRFMME are successfully integrated by RCCs in the RCOF process for producing consensus forecasts based on expert assessment of all available information

• For moving towards objective seasonal forecasts in RCOFs the use of both hindcast and real time forecast datasets disseminated either directly by GPC-LRFs or via the WMO LC-LRFMME need to be further encouraged and facilitated

• The current grib format of the available hindcast and real time forecast datasets available through the WMO LC-LRFMME is often limiting the objective use of these datasets for producing forecast and verification products for RCOFs due to limited technical capabilities to handle this data format

# Current status and future prospects for improving RCOF practices

• Running workshops designed towards specific tasks such as retrieving grib format hindcast and real time forecast datasets and re-formatting in other digital format tailored for generating regional objective seasonal forecasts and associated verification products for RCOFs is a possible way forward

• The need for downloading large volumes of hindcasts and real time forecast is problematic for countries/regions with limited internet capabilities: potential impact in some RCOFs

• Examination of new approaches to distribute hindcast and real time digital data is being performed by IPET-OPSLS sub-team 5

• Due to the lack of a well-articulated and authenticated guidance on operational practices, the methodologies adopted by different RCOFs vary widely between the regions, depending on the nature of forecast problem and the available scientific knowledge and capacity

•There are multiple sources of forecast information and multiple approaches to choose or combine them in a scientifically logical manner, imposing constraints in uniquely identifying a globally applicable and sustainable approach

# Current status and future prospects for improving RCOF practices

- IPET-OPSLS Sub-team 6 is developing guidelines on procedures for generating regional seasonal forecasts for discussion at the 2nd WMO Workshop on Operational Climate Prediction (2018), which is of great relevance for RCOFs

- Sub-seasonal forecasts are commonly demanded by the agriculture, water and health sectors in RCOFs

- IPET-OPSLS Sub-team 3 is working on scoping/implementation of a pilot set of sub-seasonal forecasts to be made available to RCCs and NMHSs via the LC-LRFMME for potential dissemination in RCOFs in the future

- IPET-OPSLS is working on developing mechanisms for WGSIP and S2S project communities to provide feedback on LC-LRFMME sub-seasonal forecast products, and access GPC data to advance research efforts

- To support emerging requirements of Polar RCCs, IPET-OPSLS will be revisiting the mandatory and highly recommended data requirements for GPC-LRFs able to provide forecast information relevant to Polar regions, and revise the GPDFS manual as necessary

# Current status and future prospects for improving RCOF practices

**Additional challenges to be addressed in RCOFs aiming at producing improved and more actionable information for users in application sectors:**

- Move beyond traditional tercile categories when issuing seasonal forecasts
- Forecast interpretation/communication (particularly uncertainty aspects)
- Tailoring/downscaling (investigate the use of post-processed daily forecast outputs in application models)
- Explore feasibility for developing rainy season onset timing prediction products
- Delivery timeliness of products and services, managing model changes and impacts on users procedures
- Incorporation of multiannual/decadal and climate change (projections) information in RCOFs

# Thank you all for your attention!