Workshop of World Meteorological Centres

Beijing, China, 26-29 March 2019

Questionnaire for World Meteorological Centres

(as of 27 February 2019)

Note: The following seven questions will be used to orient participants' discussion on:

- *Agenda III. WMCs in the context of WMO Constituent Bodies Reform*, and
- *Agenda IV. Overall coordination mechanism between WMCs and WMCs/RSMCs to support Members*.

Your answers will be distributed to all participants in advance.

I would deeply appreciate if you could send your feedback **before or on 15 March** 2019

Name of World Meteorological Centres: WMC- Montreal - Canadian Centre for Meteorological and Environmental Prediction (CCMEP), Meteorological Service of Canada (MSC)

Agenda III

1. **What areas your WMC wants to improve in near future and in the long-term by considering the functionality described in WMO-No. 49**

   Note: World Meteorological Centre (WMC). A centre of the GDPFS that has the primary purpose of issuing meteorological analyses and prognoses, including probabilistic information and long-range forecasts on a global scale. (WMO-NO. 49, Technical Regulations, Basic Documents No. 2, Volume I – General Meteorological Standards and Recommended Practices)

The Meteorological Service of Canada WMC in Montreal currently produces both Deterministic and Ensemble Numerical Weather predictions at global, and regional scales with the aim of evolving towards seamless systems further supporting the various prediction and services processes and requirements. With the pace of development over the last few years, we must ensure and/or consider that (1) Model performance assessment methods within the research to development of applications and post-processing to operations must evolve accordingly to be timely and useful for real-time verification and decision making. For automatically generated forecasts, meteorologists must be able to determine whether they will need to intervene and adjusts forecasts. (2) The integration of Artificial Intelligence or linkages/coupling with other systems to better able a vigilance approach regarding hydro-meteorological hazards (reducing potential sector specific impacts) for longer lead times of up to 7 -14 days. (3) Increasingly efficient methods of technological transfer and project management. This needs to be managed in the midst of IT system upgrades and implementations.

2. What could be additional roles of your WMC to support the WMO Constituent Body Reform and Strategic Plan of WMO, especially Strategic Objectives 2.3

Note: Strategic Objective 2.3: Enable access and use of numerical analysis and prediction products at all temporal and spatial scales from the WMO seamless Global Data Processing and Forecast System

References:

- *Reform presentation - CBR-TF-sc,*
- *Constituent Bodies Reform - substructures and presidents and vice presidents,*
- *EC70 Strategic Plan*

Available at http://www.wmo.int/pages/prog/www/DPFS/Meetings/WMCs-Workshop_Beijing2019/Docplan.html

(1)In addition to responsibilities with respect to RSMC Nuclear Emergency Response Centre, RSMC Geographic Centre for Atmospheric Modelling, Volcanic Ash Advisory Centre, Numerical Ocean Wave Prediction, Canada has initiated work working on establishing a Regional WMO VFSP-WAS (Vegetation Fire and Smoke Pollution Warning and Advisory System) Center. This Regional VSFP-WAS centre will be able to assist WMO Members in the region in forecasting vegetation smoke emissions, smoke transport and consequences for air quality and health and to evaluate the capacity of countries in the area in supporting/providing such facilities. This centre will support international policies needed to address impacts of vegetation fires that are of transboundary nature.

(2) Regional reforecasts and reanalysis of environmental variables (hydrology, Air quality) for North America

Agenda IV

3. Please provide the name of organizations that you are currently working with / worked / will work, identifying the nature of the work and your role and responsibilities.

Note: organizations can be UN agencies, NGOs, Regional entities such as RIMES and other GDPFS Centres

We obtain data from several organizations within or outside our federal government and provincial departments. For example, all satellite data obtained for assimilation into the NWP or detection of forest fires locations by post processing of satellite data by Natural Resources Canada department. We share information and data with various components of NOAA, in particular within the framework of NAEFS (North American Ensemble Forecast System, also involving Mexico), and with ECMWF. We cooperate at the international level in the research and development of the WaveWatchIII wave model and the NEMO (Nucleus for European Modelling of the Ocean) oceanic model.

We have contributed on several occasions to international research demonstration projects, such as those related to the 2008 Beijing and 2014 Sochi Olympic Games. We are currently participating to the Year Of Polar Prediction (YOPP) with among other activities the production with experimental status of a coupled ice-ocean-atmosphere prediction system over the entire Arctic ocean basin and bordering landmass.

Additionally:

Other GDPFS Centres

CTBTO, ICAO, WMO – Atmospheric dispersion, VAAC and RSMC Nuclear

National Weather Service and the National Meteorological Service of Mexico: North American Ensemble Forecast System joint operational ensemble

Recently established collaboration with RSMC-Dakar on SWFDP West Africa and RFSF-Fort de France on the Eastern Caribbean SWFDP for the provision of meteorological information in image format or through geospatial services.

We also provide satellite imagery and maintain a website for the meteorological service of the Republic of Haiti (and provided support in the re-establishment of their services).

NOAA VAAC Washington – Backup of VAAC services

4. In relation with question 1, what are the most difficult challenges you met and how you did overcome it, if you did.

New versatile forecast verification platform and processes are being considered and implemented in order to assess model performance

5. Is there a good example of coordination mechanism between your WMC and other centres you want to share. Tell us why it is a good example of coordination mechanism.

The North American Ensemble Forecast System is a good example of collaboration between WMC Montreal, the National Weather Service and the National Meteorological Service of Mexico. This has allowed the generation of a set of forecast products that are seamless across the national boundaries between Canada, the United States and Mexico. The research/development and operational costs of the NAEFS system are shared by the three organizations (MSC, NWS, and NMSM), resulting in higher quality and more extensive weather forecast products. Collaboration mechanisms include regular discussions related to data and model development, post processing, verification and product generation.

6. As a WMC, do you have specific request to make to SIDS and LDCs to help improve your system?

Note: For instance, Ghana utilized cloud resources with Reading University for forecasting drought. They provided their observations which were assimilated in UKMO Land Surface Model to enhance quality of drought forecast.

Feedback and observations through collaborative activities is required in order to validate outputs and services.

7. LDCs and SIDS are interested in not only chart-type products but also NWP output. To help them to develop applications (post-processing), how do you see your WMC addressing these needs?

(1) Access to data is one big issue, but also access to data processing capacity. It is important to provide access to meteorological data in ways that promote its use in the user's own workflow. This puts a large premium on interoperability and means that the data has to be discoverable by open industry standard protocols, and recoverable by open, interoperable APIs.

The MSC has deployed a large capacity geospatial data server that makes data available in a variety of ways, but most purposefully using the Open Geospatial Consortium standards as a means of delivery and compatibility with end-user visualization and data processing platforms. Once the interoperability of data and meta-data is secured, then everything is less sensitive to the evolution of data processing platform themselves, be they local or cloud-based.

User-friendly and up-to-date documentation is currently being developed in order to define how to access this geospatial data service in order to support Web map services for users.

(2) MSC also holds a 'Datamart', an open data server, through which users may download Numerical Weather Prediction data (GRIB) and bulletins and other data (XML as per type of product) produced by the WMC. This system implies importing large files (through HTTP) with global data coverage and implies the need for IT capacity. NWP data includes global, regional and ensemble data among others).

(3) The establishment of collaborative IT capacity and sharing of expertise could also be an avenue of support.

(4) MSC is working with Copernicus and NOAA, and in collaboration with WMO, in examining the possibility of organising special AQ training for African countries.