World Meteorological Centres Workshop

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: U.S. National Oceanic and Atmospheric Administration / National Weather Service

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)

NCEP has been at the forefront of distributing real-time forecast guidance from various modeling systems primarily in support of the following, in addition to providing initial and lateral boundary conditions for various regional and global models across the world:

(a) 16-day Medium range global weather forecasts from operational Global Forecast System (GFS) and Global Ensemble Forecast System (GEFS) four cycles a day
(b) 126-hr Tropical Cyclone forecasts for all global tropical cyclone basins from operational Hurricane Weather Research and Forecast System (HWRF)
(c) 5-day NCEP Global Aerosol Capability (NGAC) forecasts
(d) 5-day Global Wave Deterministic and Ensemble Forecasts
(e) Real-time Ocean Forecast System (RTOFS)
(f) Seasonal Forecasts from operational Climate Forecast System

NOAA is moving towards developing and implementing Finite Volume Cubed Sphere (FV3) dynamic core based Unified Forecast System (UFS) that will include coupled earth system models for all spatial and temporal forecast guidance. The earth system components are derived from FV3 based atmospheric model, Modular Ocean Model (MOM6), Clone of The Los Alamos sea ice model (CICE5), Wave Watch III wave model,

Goddard Chemistry Aerosol Radiation and Transport (GOCART) model, Noah land surface model, and strongly coupled data assimilation systems of these earth system models using Joint Effort for Data Assimilation Integration (JEDI) framework.

The first version of UFS will be FV3 based GFS planned for implementation in June 2019 and is expected to provide improved medium range global weather forecasts. The FV3 based GEFSv12 is scheduled for operational implementation in 2020 that will enable ensemble based probabilistic weather forecasts for sub-seasonal scales (weeks 3&4) using 31 ensemble members operating at 25 km resolution.

In addition, we will support and enhance capabilities to provide reliable probabilistic guidance for atmospheric dispersion and air quality prediction.

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

To improve and provide multi-model ensemble predictions with calibration through NAEFS project and other international probabilistic based product generation projects.

To improve and provide enhanced tropical cyclone track, intensity, structure and rainfall predictions for all global tropical cyclone basinsTo improve and provide real-time guidance for space weather prediction capabilities

To continue and improve our emergency response function as a Regional Specialized Meteorological Center for emergency response atmospheric dispersion activities.

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

North American Ensemble Forecast System (NAEFS) is jointly developed by US National Weather Service, Canadian (Meteorological Service of Canada) and Mexican (National Meteorological Service of Mexico). NAEFS producing centers (MSC and NWS) have:1) Exchange in real-time raw forecast data (operational since September 2004) and bias corrected forecast (operational since March 2011) for about 90 variables 2) Statistically post-process (include downscaling) all ensemble members;3) Jointly develop and produce end products based on the combined ensemble of forecasts. NAEFS products could be accessed in real time through NOMADS and ftp publically.

See WMO ET-OWFPS latest documentation (7.1.1 – 7.1.5)

NCEP is a Regional Specialized Meteorological Center (RSMC) for emergency response dispersion activities serving regional III and IV (along with RSMC-Montreal) for provision of dispersion predictions of radiological and non-radiological plume prediction. Global and regional meteorological forecast systems are used to drive dispersion models. This project is coordinated by WMO and also supports IAEA requests.

NCEP supports the Comprehensive Test Ban Treaty Organization (CTBTO) by providing source-receptor information when a CTBTO receptor measures radionuclide material. The NWS Global Forecast System (GFS) Data Assimilation System (GDAS) is used to estimate source information by running the HYSPLIT dispersion model in backward analysis mode.

NCEP supports the Washington Volcanic Ash Advisory Center (VAAC) with provision of HYSPLIT dispersion modeling capabilities for volcanic ash prediction. This program is coordinated through ICAO.

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

WMO played a strong coordinating role for developing and improving the RSMC program for emergency response activities. Regular meetings and coordination activities by WMO, IAEA and ICAO helped to create a functional emergency response capability to National Meteorological Services (NMSs) for atmospheric dispersion prediction.

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 RSMC program uses web based tools to share dispersion model predictions with other centers (National Meteorological Hydrological Centers, NMHC). Detailed summaries on plume behavior, expected transport and meteorological conditions are coordinated amongst lead centers. Monthly exercises are coordinated with participating centers with quarterly exercises led by IAEA. The various NMHCs have found that exercising response capabilities to be a good way to ensure procedures continue to work in evolving operational environments.

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.

As an RSMC, we request that a web master be assigned to keep all related documents and on WMO Emergency Response Activities web site be kept up to date. A new technique was developed at RSMC-Washington named the Transfer Coefficients Matrix (TCM) technique. This capability allows RSMCs to update the contaminant source term easily and more readily throughout the event. This technique was presented and well received at the last RSMC meeting in October, 2018 in Vienna, Austria. It is requested that the capability be operationalized either at IAEA, WMO or a capable RSMC for general use.

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?

Our WMC is investing on provision of post-processed products using traditional bias correction but also new machine learning algorithms. Probabilistic ensemble based products will continue to be enhanced for more applications by improving our global and regional ensemble forecast systems. Current work includes unifying our ensemble systems around a single dynamic core, enhancing the horizontal and vertical resolutions of each member, and improved diversity in physics and initial conditions.

NWS continues to provide these model outputs to public and private institutions for enhanced access and display.