ANNUAL JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL TAPROCESSING AND FORECASTING SYSTEM (GDPFS) INCLUDING NUMERICAL WEATHER PREDICTION (NWP) RESEARCH ACTIVITIES FOR 2016

Sudan / Sudan Metrological Authority (SMA)

1. **Summary highlights:**

This report labels the essential features of the Numerical Weather Prediction (NWP) systems operational at Sudan Meteorological Authority (SMA) throughout the year 2016.
The systems are based on Environmental Modelling System (EMS) maintained by NOAA/NWS Science and Training Resource Center (STRC) and is a complete, full-physics, state-of-the-science numerical weather prediction (NWP) package that incorporates dynamical cores from both the National Center for Atmospheric Research (NCAR) Advanced Research WRF (ARW) and the National Center for Environmental Predictions' (NCEP) non-hydrostatic mesoscale model B-grid (NMM-B)* releases into a single end-to-end forecasting system. All the capability of the NCEP and NCAR WRF models are retained within the EMS

There are no projects and research work to address development and improvements of specific features of the NWP models or verification at SMA.

2. **Equipment use :**

The operational Weather and Research Forecast (WRF-EMS) is running at early warning unit with 4 x 8 cores, 2 threads per core and 16 GB RAM with CPU power of 800 MHZ under Ubuntu 12.4 O. S. The WRF-EMS system is running in two identical units for generating 7 and 10 KM resolutions products.

3. **Data and Products from GTS in use:**

Currently, SMA is not using GTS data for Numerical Weather Prediction.

4. **Forecasting system:**

4.1 System run schedule and forecast ranges

The numerical weather prediction NWP system at the early warning unit of SMA is based on WRF- EMS model, which is run automatically once a day at (00 UTC), providing 120 hrs forecasts. The initial and boundary conditions are obtained from GFS model.

4.2 Medium rang forecasting system (4-10 days) :

Not applicable

4.3 Short- rang forecast system (0-120 hours):

4.3.1 Model

WRF-EMS

4.3.1.1 in operation

WRF-EMS model is adopted for operational short range (up to 5days) forecasts over Sudan. Resolution 07km, 26 levels, time range 120hrs.

4.3.1.2 Research performed in this field

There is no research in this area done by SMA

4.3.2 Operationally available Numerical Weather Prediction (NWP) Products

5 Days forecast for the following major elements:

- Wind at different levels
- Temperature
- humidity
- soil moisture
- precipitation
- Mete-grams and sounding for all observation stations.

4.3.3 Operational techniques for application of NWP products (MOS, PPM, KF, Expert Systems, etc.)

Not applicable

4.4 Now-casting and very short rang forecasting system (0-12 hrs):

Not applicable.

4.5 Extended range forecast (10 days -30 days)

Not applicable

4.6 Long range forecasts (30 days up to 2 years)

Not applicable

5. Verification of prognostic products

Not applicable in SMA

6. Plans for the future (next 4 years)

- Upgrade Computational power to enhance NWP output resolution to be up to 5 KM.
- Increase the number of experts and scaleup their capacity.
- Apply dynamical downscaling for generating seasonal forecast climate change product using WRF model, RegCM and PRECIS.
- Implement verification system to validate model quantitative output using **MOS** on regular basis.
- Apply Data Assimilation using ground observation using **KF.**