**WORLD METEOROLOGICAL ORGANIZATION**

**COMMISSION FOR BASIC SYSTEMS**

**OPAG on DPFS and PWS**

**Technical Planning meeting on the Implementation of Severe Weather Forecasting Demonstration Project (SWFDP) in Western Africa**

**Abidjan, Ivory Coast, 4-8 September 2017**



**Final Report**

**8 September 2017**



**1. Opening**

The Technical Planning Workshop for the implementation of SWFDP in West Africa was opened at 09:30 hours on Monday, 4 September 2017 in Abidjan, Ivory Coast by Mr. Daouda Konate, Director of National Hydro-Meteorological Service (NHMS) of Ivory Coast, and by Mr Abdoulaye Harou, Chief of Data Processing and Forecasting System (DPFS) Division at World Meteorological Organization (WMO) Secretariat.

In his opening remarks Mr Konaté welcomed the participants in Abidjan for their meeting to develop the implementation plan for SWFDP-West Africa. He recalled the request made to WMO Secretariat, at the RA-I meeting in Praia, Cabo-Verde in 2015, to implement the SWFDP in the rest of Africa, noting that it is already implemented in Southern and Eastern Africa. He thanked WMO Secretariat for taking steps to implement the project in West Africa sub-region. Mr Konaté expressed, in his quality of Vice President of RA-I, and on behalf of the President of RA-I, his gratitude to WMO Secretariat for organizing this meeting. The RA-I strongly believes the project will make a difference in the sub-region enabling NMHSs to improve their forecasts and warning services to the citizens and users they serve for safety of life and livelihoods. He concluded by wishing an excellent meeting to all.

On behalf of the WMO Secretary General, Professor Petteri Taalas, Mr. Abdoulaye Harou expressed sincere appreciations to the Government of Ivory Coast for hosting this event in Abidjan and to the NHMS of Ivory Coast for making arrangements for the meeting. He mentioned the importance of improving severe weather forecasting in climate change scenario as climate change is manifested through extreme weather events in terms of frequency and/or intensity. He remarked that advancement in NWP in term of precision have led to increasingly skillful and reliable weather forecasts over the last two decades. It is in this context that the SWFDP is intended to enhance the use and application of outputs of state-of-the-art NWP systems, available through WMO, to improve severe weather forecasting in countries where such NWP outputs are either unavailable or poorly used and to deliver timely warning services to the users. He also extended WMO gratitude to Mr Daouda Konaté and his staff, including the local organizing committee, for their excellent work in making arrangements for the meeting. He also conveyed his appreciation for the interest the participants had in the project.

**2. ORGANIZATION OF THE MEETING**

**2.1 Adoption of the agenda**

The meeting adopted the provisional agenda, which is found in **Annex I** of this report.

**2.2 Working arrangements**

The meeting agreed on the organization of its working hours and session arrangements. The Agenda and other documents have been made available on the WMO website at the following link: http://www.wmo.int/pages/prog/www/DPFS/Meetings/RAI-WA-SWFDP\_Abidjan2017/DocPlan\_001.html

NMHSs of eleven countries in West Africa were invited to attend the meeting. However, the meeting was attended by representatives of NMHSs from nine countries including Benin, Burkina Faso, The Gambia, Ghana, Guinea, Ivory Coast, Mali, Senegal and Togo. NMHSs of Cabo Verde, Nigeria and Niger could not attend the meeting. In addition, the meeting was attended by the representatives of relevant global and regional centres including Meteo France, RSMC Dakar, ACMAD, and DMN Morocco and of ECMWF who gave a presentation remotely through video conferencing. UK Met Office and US NOAA/NCEP could not send their representatives. Therefore, a total of 20 people participated, including from the host country and the Secretariat. A list of the participants is available in **Annex II.**

**3. INTRODUCTION TO SWFDP**

**3.2 SWFDP Framework including Overall Project Plan and Guidebook**

Mr Harou provided information on the SWFDP framework, including overall project plan and on the SWFDP Guidebook. He noted that SWFDP is a cross programmatic activity organized within the Commission for Basic Systems (CBS) at WMO and lead by the Data Processing and Forecasting System (DPFS) Division in close collaboration with several related WMO Programmes including Public Weather Services (PWS), Agriculture Meteorology (AgM), Marine Meteorology and Oceanography (MMO), Disaster Risk Reduction (DRR), Hydrology and Water Resources (HWR) and Tropical Cyclone Programmes. The project is guided by the CBS through its Steering Group on the SWFDP which has developed two basic documents including SWFDP Overall Project Plan and SWFDP Guidebook for Planning Regional Subprojects towards implementation of a mechanism to strengthen operational centres. These two documents are reviewed and updated by the Steering Group periodically and are available at WMO website at the following web link: http://www.wmo.int/pages/prog/www/swfdp/index\_en.html.

All SWFDP regional subprojects are developed and implemented as per guidelines provided in these documents. The SWFDP Guidebook describes the planning process and the wide range of considerations for developing a subproject. The subprojects are developed in phased approach with involvement of relevant Global, Regional and National Centres to make efficient use of the these GDPFS centres in implementing ‘cascading forecasting process’.

The subproject implementation requires a management and accountability framework including a Regional Subproject Management Team, which sustains the implementation and review, through accountability at the level of the Permanent Representatives or delegates of participating countries. The participating countries and centres have important responsibilities and respective roles to play. The conceptual framework for the SWFDP is the “Cascading Forecasting Process” (moving information from Global, to Regional to Local levels), and training and capacity development are both supported through specific activities and the project’s organization.

The meeting was informed about the progress made so far in the development and/or implementation of SWFDP regional subprojects in various sub-regions in the World including West Africa. The meeting was informed that the SWFDP has proven to follow a systematic and practical approach for developing capacity of the NMHSs on improving the understanding and the use of the NWP outputs and satellite information, and for transferring new knowledge and skills to the forecasters. The SWFDP which was started with involvement of just six countries in southeast Africa in 2006 has now been benefitting over 50 developing countries including LDCs and Small Island Developing States (SIDSs) in Southern Africa, Southwest Pacific, Eastern Africa, Southeast Asia, Bay of Bengal and Central Asia. The development of SWFDP regional subprojects in Western Africa and the Caribbean have also been initiated.

**3.2 Summary of the inception meeting (Dakar, Senegal, November 2015) and Progress towards development planning of SWFDP-West Africa since 2015**

The meeting noted that initial inception discussion for the implementation of SWFDP regional subproject in West Africa was held in December 2015 in Dakar (Senegal) after request by the Regional Association I (Africa) at its meeting in Praia (Cabo Verde) in February 2015, request which was endorsed by the 17th World Meteorological Congress (Cg-17) in Geneva in June 2015. To kick start the process to initiate development process, The Korea Meteorological Administration (KMA) provided seed funding. Subsequently, a short mission to Senegal Meteorological Service was carried out in May 2015 to seek information on operational weather forecasting services in Senegal and to discuss the potential role of Regional Specialized Meteorological Centre (RSMC) Dakar within the framework of SWFDP in Western Africa. Following this mission, a technical planning and training workshop on Severe Weather Forecasting and Warning Services (Dakar, Senegal, November 2015) was held to: gather information on the forecasting and service delivery capabilities in the NMHSs of countries in the sub-region; provide initial training on severe weather forecasting and delivery of warning services; and develop outline of the Regional Subproject Implementation Plan (RSIP) for West Africa. Since then, the following activities were carried out to facilitate the development of subproject:

* Capacity development of RSMC Dakar (the Senegal Meteorological Service) on data assimilation in order to improve NWP LAM capacity at RSMC Dakar for the issuance of guidance for NMHSs in Western Africa within the context of the SWFDP. An expert from Senegal attended a course at the International School on Data Assimilation during 24-26 June 2015 in KMA in the Republic of Korea.
* Capacity development of RSMC Dakar on NWP usage and interpretation to develop the RSMC capacity in making best use of the high value NWP information for the issuance of Severe Weather Forecast Guidance for the NMHSs in West Africa. Two operational forecasters from the RSMC Dakar were supported for their participation in an ECMWF training course during 3-7 October 2015 on use and interpretation of ECMWF products.
* Development of outline of the draft Regional Subproject Implementation Plan (RSIP) for West Africa
* Enhanced access to the ECMWF products through the purchase of ecCharts license (NMHS Non-commercial) for two years for RSMC Dakar
* Development of initial version of project website (RSMC Dakar)
* Improvement of public weather services delivery in Ghana and Senegal. A Television Weather Presenter Training was held in Accra, Ghana during 14-18 November 2016. In the training which was organized by WMO in collaboration with the UK Met Office, seven (7) meteorologists were trained to be TV weather presenters and four (4) meteorologists were trained to be producers. The training assisted Ghana Meteorological Service (GMet) to provide TV weather services to a large population of Ghana that was previously not receiving high quality forecasts. Similarly, TV weather studio at Senegal Meteorological Service is to be modernized in collaboration with UK Met Office. The acquisition, testing, shipping and installation of the equipment is expected to be completed in Q3/Q4 2017. UK Met Office will also provide training on use of the equipment to the staff of Senegal Meteorological Service through VCP.

The meeting noted that slow but steady progress had been made towards development planning of SWFDP-West Africa since 2015. Delay in some of the development activities was mainly due to the limited extra-budgetary resources. However, the meeting extended its appreciation to the donors especially KMA for providing support to kick start the development process. The meeting also appreciated UK Met Office for its in-kind contributions in improving service delivery aspects of SWFDP in Ghana and Senegal through sourcing TV studio equipment and providing production and presenter training.

The meeting also noted that substantial additional resources are required to sustain the development process and further implementation of the subproject including capacity development of NMHSs in the sub-region. Appreciating efforts of WMO Secretariat, the meeting recognized that this can be achieved by involvement of multiple donors to support various activities as appropriate and as envisioned in the Regional Subproject Implementation Plan (RSIP). The meeting also noted the need of alignment of project activities with other relevant regional/sub-regional and/or country specific projects in West Africa being funded through various donors e.g. CREWS, GCF, USAID, AFDB, WB, KMA etc.

**4. SWFDP’s CASCADING FORECASTING PROCESS:**

**4.1 Roles of Global Centres and products availability**

**4.1.1 Meteo-France**

The meeting noted that Meteo France has observational, telecommunication, training and forecasts means in order to answer its own needs linked to national issues, but also for international cooperation coordinated by and for WMO.

In this context, Atmospheric and oceanographic deterministic model ARPEGE 0.1, Ensemble Prediction System ARPEGE and nowcasting products such as Rapidly Developing Thunderstorms (RDT) routinely available, are Meteo France raw data produced operationally that can be of interest to SWFDP West Africa project. Meteo France showed willingness to provide, in the context of the SWFDP project, these data through a telecommunication system agreed on with SWFDP-West Africa participating countries. This telecommunication system must, as much as possible, respect telecom good practices recommended by WMO Information System (WIS). Meteo France proposition is to implement a Data Collection and Production Centre (DCPC) solution in order to provide these data; the precise set of data needs to be established in collaboration with West Africa participating countries.

The meeting noted also that Meteo France could propose training sessions following its permanent training catalogue with training taking place at Meteo France School of Meteorology in Toulouse (France), or with experts in countries participating to SWFDP project. All this training session will occur in collaboration and with support of WMO.

**4.1.2 ECMWF**

The representative of ECMWF, Ms Anna Ghelli, made a presentation remotely through a video conference. The presentation covered an introduction to the organisation, its strategy in relation to ensemble forecasting and some example of products that will be made available to the SWFDP. The meeting was informed that ECMWF is an intergovernmental organisation supported by 34 Member States. Its NWP model outputs are provided to MNHSs in the 34 Member States who post-process the data and use them in their daily weather forecasting processes. A selection of ECMWF model output is also made available to WMO countries.

The presentation put a particular emphasis on ensemble forecasting which, by providing also information on the uncertainty associated to the forecast, better support forecasters in their daily duties, especially, in cases of severe weather events. Examples of products based on ensemble forecasts are the Extreme Forecast Index (EFI), Cumulative Distribution Function and ENS Meteograms.

ecCharts, a web based application to explore and visualize ECMWF data was also presented. It is regulated by a licence and it is available to WMO countries (NMHS Non-commercial) for a fee of 3500 Euro per year.

**4.2 Roles of Regional Centres and of a few advanced NMHSs**

* + 1. **Morocco**

The representative of DMN Morocco, Mr Driss Khalfi, presented on the DMN contribution potential by highlighting its capacity and plans, including:

* Its human resources (744 employees including 220 cares and 43 technicians, 86 Agents).
* Continuing training aimed at strengthening the capacities of its staff, both managers and technicians.
* The reinforcement of observations (automatic stations, radars, lightning network, etc.).
* The improvement of its information system by improving the flow rates of the Telecom links; the project to acquire a new data visualization system and, above all, the project to set up a new, more powerful HPC to further improve its numerical models and its data archiving capacity.
* The complexity of its DMN telecommunication network, which interconnects the data transmission and processing center at the national level with other DRMs, CPMs, Airports and CCR (ONDA) and also with global and regional centers ( Toulouse, ECMWF, Algiers etc.), allowing a fast and secure exchange of data between these centers and the DMN.
* Its regional contribution as a RIC (Regional Instrumentation Center), Global Information System Center (GISC), RCC (Regional Climate Center);
* And the introduction of a quality management system (QMS) over the past ten years, enabling DMN to be ISO 9001 certified.

The quality of cooperation between DMN Morocco and other global centers (ECMWF, Météo France) and regional centres (RSMC Dakar) was also recalled in terms of services, data, weather forecasting and training.

The meeting noted that DMN strategy for strengthening its capacities in terms of both infrastructure and human expertise, as well as in terms of the exchanges established with global and regional centers, make it a center with adequate potential to assist WMO Members in West Africa with training in forecasting, NWP, and instrumentation related area.

**4.2.2 RCC ACMAD**

Mr Léon Guy Razafindrakoto informed the meeting that the African Centre of Meteorological Applications for Development (ACMAD) will provide  the NWP products from UKMO global model disseminated through EUMETCast. Maps in jpeg format could be made available on ACMAD’s intranet after a post processing of grib2 files with GrADS software. A WRF Africa model, with 9 km horizontal resolution, is planned to be implemented in the context of the Satellite and Weather Information for Disaster Resilience in Africa (SAWIDRA) project running over Africa and could be accessible via a link for RSMC Dakar web site. West Africa Synthetic Analysis/Forecast (WASA/F) and Intertropical Discontinuity (ITD) maps could be made available. ACMAD will consider also the hosting of NMHS staffs for « On the Job Training » or on secondment at ACMAD for capacity building. NWP/DRR workshop could be also organized to promote interaction of NWP/PWS with DRR community.

**4.3 National Meteorological Centres (NMCs)/NMHSs**

The representatives of NMHSs from Benin, Burkina Faso, The Gambia, Ghana, Guinea, Ivory Coast, Mali, Senegal, and Togo provided updated information on monitoring, forecasting and warning capacity of the NMCs/NMHSs including needs and gaps and expectations from SWFDP-West Africa. They also provided information on major gaps in terms of their capacity to provide early warnings and on the important thresholds for weather warnings in their respective countries.

The respective presentations by all participants will be made available on the SWFDP-West Africa website at RSMC Dakar**.**

**4.3.1 Benin**

The meeting was informed by Mr Boris Polynice Anato that the National Meteorological Agency (Meteo Benin) was created in September 2015 and became operational in January 2016. Meteorology in Benin has for long been managed by ASECNA, whose sole vocation is aeronautics. This situation did not favor the emergence of other meteorological areas, but the young agency is working to strengthen the national meteorological service. The Agency's new headquarters is finally ready to consolidate the Agency's staff which is dispersed on various airports. Currently, one of the biggest challenges of Meteo Benin is the operationalization of its National Weather Forecasting Center.

In order to improve its performance and to meet the growing needs of users, especially in terms of weather forecasting, Meteo Benin has to find appropriate solutions to the many difficulties it faces. The necessary staff, equipment and tools are needed to strengthen the Agency's various services, especially its forecasting services.

**4.3.2 Burkina Faso**

Mr Guillaume Nakoulma briefed the meeting on the National Agency of Meteorology (ANAM) of Burkina Faso. He indicated that ANAM has technical equipment enabling it to carry out the various activities that fall under its responsibilities. A few examples of equipment include:

* conventional observation stations;
* automatic observation stations;
* a radiosonde station;
* a satellite imagery and PNT product receiving station (PUMA 2015); of major world centers (ARPEGE, NCEP, UKMO) outputs;
* a data and product receiving station for environmental monitoring (MESA 2015);
* two meteorological radars based in Ouagadougou (broken down) and Bobo Dioulasso acquired by the Time Alteration Program;
* Internet for access to data, products disseminated by some major PNT centers (NCEP, UK Met Office, NCEP).

The various activities are carried out with human resources composed of PhD qualified personnel, forecasters, weather engineers, senior weather technicians, weather technicians, instrument, equipment and computer technicians as well as observers. This staff is responsible for the preparation and production of the following newsletters: weather alerts, daily newsletter, synthetic weekly bulletin, agro-meteorological bulletin, seasonal forecasts. These bulletins are distributed through several channels: internet (mailing list), website, radio, press, television and social networks (Facebook).

The meeting noted that in Burkina Faso, the phenomena that trigger early warnings are: heavy rain, strong winds, heat waves, Sand and Dust. For these phenomena, alerts are made through social networks (Facebook), in forms of bulletin for civil protection and through a visualization platform (for the city of Ouagadougou).

To improve the reliability of its information, ANAM-Burkina Faso will need fine-mesh PNT products, Meteo France's RTD and models products and products from the global predictions centres such as UKMO and ECMWF.

Expectations for Burkina from SWFDP-West Africa include strengthening technical and operational capacities through equipment and training, increasing the Internet speed, providing the Dakar RSMC with a platform for disseminating forecasts of extreme events.

**4.3.3 The Gambia**

The representative of the Gambia Meteorological Service, Ms Fatou Sima, informed the meeting that the NMHS rely on a network of 10 synoptic stations, 1 Marine, 26 rainfall stations, 11 AWS. There is no Radar. From 1945 to 1977, the service operated 10 synoptic stations and provides weather observations and Pilot balloons ascents. From 1979 to present, started operational forecasting including weather observations, surface chart plotting and analysis. The Marine station started operation in October 2012 to date. The rainfall stations started 1886 to date but there are some data gaps. The warning criteria for severe weather events are Strong winds, Rough Seas, Severe thunderstorms/ dust storms and Flash Flood. The Meteorological Service has 1 PhD 3 BSc, MSc, 4 BSc,14 Technicians (Senior level), 38 Technicians (Junior level) and 30 support staff. 2 are on training in Meteorology in China (1 BSc & 1 MSc).

OPMET data and other Met information are accessed through the AFTN, SADIS, PUMA and Internet. EUMETSAT is used for Satellites. NWP products are obtained from NCEP/NOAA, ECMWF, Meteo-France UKMO, AEMET and DWD. In 1979, Satellite equipment with internet were installed. MSG has been operational since June 2005 with upgrade done in 2010. Additionally, NMHS make use of PUMA Station, Satellite Distribution System for Aeronautical Navigation information (SADIS-2G) Satellite Display and EUMETCast-Africa Reception Station (MSG/ PUMA): EUMETSAT’s broadcast system for environmental data.

The service provides 24 hour weather forecast & Warnings, Marine forecast and Seasonal Forecast. Both the daily and the Marine forecast are broadcasted at the Gambia Radio and Television Services (GRTS) for the public. The Forecasts and Warnings are also incorporated in the decadal Early Warning Bulletin and disseminated to Regional centres (AGRHYMET, ACMAD, Aviation, Fisheries and Fisher folks, Farmers, Agriculture, Health service, stakeholders, decision makers & etc.). The seasonal forecast is also presented and televised at the GRTS. All the forecast, bulletins and reports are on a web site: www.mofwrnam.gov.gm.

The meeting noted that through a GEF/UNEP funded project namely “Climate Change Early Warning System Project (EWSP)”, which was started in 2011 and managed by the Department of Water Resources (DWR), infrastructure at Central Forecast Office, Climatology, Agromet, and Regional stations were strengthened in 2012 through provision of computers. In Phase II of the project, 9 AWS were installed at 9 synoptic stations. EWSP also bought SSB Radios & Community Radios for transmission and communication of weather information to the central offices and across the country. The African Climate Policy Centre (ACPC) bought 2 AWS and which were installed at Keneba and Kanjibat. In 2014, ACPC also funded the Met. service to Rescue Climate Data resulting in Data being rescued, in image format, for the period 1886-2012. Effort is underway to solicit funding to digitize the image data and also to rescue the remaining data from 2013 to date.

The NMHS of Gambia is able to strengthen consultations and collaborations with stake holders, focus groups, Radio and Television Broadcasting. However, there are several challenges including obtaining funding and assistance to acquire the following: (i) RDT products, (ii) new equipment to replace mercury equipment, (iii) Strengthen the capacity of personnel ,(iv) AWS for closed synoptic stations (revitalized), (v) Need more NWP models, (vi) Need studio for forecasting presentation and training of presenters.

**4.3.4 Ghana**

Mr Ayilari-Naa Juati, the representative of Ghana, briefed that weather observations started in Ghana, then Gold Coast, in the 1830s under the colonial rule. These increased in number to include climatological, Agro meteorological and Synoptic stations by Independence when the Meteorological Service Department was established under the Civil Service. In December 2004, an Act of Parliament, Act 682 established the Ghana Meteorological Agency (GMet), which metamorphosed from the Meteorological Services Department, as a semi-autonomous entity with the following Mandate: To provide advice to Government on climate and weather related issues for policy formulation and planning. It is also the sole authority to approve the establishment of Meteorological stations. It mandate includes the provision of Met information, guidance and warnings on severe weather for aviation, integrated water resources management, energy, operational hydrology and for disaster risk reduction and recovery among others. It is exclusively required to collect, process and disseminate meteorological data and information nationally and internationally in line with WMO standards.

GMet has quite a good network of weather monitoring stations and facilities with a competent and technical staff driven by the desire to offer innovative services for rapid socio-economic development. These include a C-Band Dual Polarization Weather surveillance RADAR, satellite receiving systems, automatic weather stations and rain gauges, Weather Modelling, Database Management, Television Weather studio among others. The Agency has a large number of stakeholder institutions including Civil protection and emergency management , agriculture, research and Universities, Energy, water resources, public weather, environmental protection, aviation , marine, oil and gas among others.

Inadequate financial resources, resulting from poor budgetary support from Central Government and the inability to recover costs for services provided tend to impinge negatively on the operational efficiency of the Agency.

The meeting noted the following areas of focus:

* Data Assimilation into the Weather Research and Forecasting (WRF) Model and the World Bank GFDRR funded Flood and Early Warning System over the White and Oti Volta basins (FEWS-Volta, FEWS-Oti).
* Enhancing the timely dissemination Public Weather services and Severe Weather warnings with high skill and good lead times, through print and electronic media as well as Social Media.
* Developing capacity to use ICT (IoT, AI etc) to boost our operational efficiency.
* Continued participation in the UNDP funded Community Resilience through Early Warning Project (CREW)
* Climate change and variability monitoring and participation in the development of the National Communication to UNFCCC.
* Design tailor made services for oil and gas operations
* Deeper collaboration with our Regional and International Specialized Meteorological centers like ACMAD, AGRHYMET, UKMO, ECMWF, Meteo France etc.

**4.3.5 Guinea**

Mr Goikwia Koiba from Guinea briefed the meeting that the Meteorological Service of Guinea faces many difficulties in responding to forecast needs of the general public, due essentially, to:

* limited number of equipment (dilapidation)
* limited observation network;
* Inexperience of forecasters;
* The lack of financial resources;
* limited Internet connection (expensive);
* Difficult access to NWP products from global, regional and NMD (advanced) centers;
* Weak communication process between meteorology and users.

These areas are seen as major challenges faced by Guinean Meteorological Department. Support from WMO and its partners is highly desired.

As a matter of priority, the following are required to be addressed:

* Training in Nowcasting, medium range forecast, service delivery;
* Observing Equipment
* Participating in projects related to disaster prevention in West Africa

**4.3.6 Ivory Coast**

Mr Alain Gnayoro described the situation of the SODEXAM (Société d'Exploitation et de Développement Aéroportuaire, Aéronautique et Météorologique) / DMN (Direction de la Météorologie Nationale). The meeting noted that the organization has experienced staff and the following equipment and arrangements: 6 automatic weather stations (AWS) and 13 synoptic stations; rainfall network for the city of Abidjan with a raingauge in each city district; a national unit for operational disaster risk management, access to observing network (automatic stations) of partners; and a NWP model recently acquired.

There are, however, some weaknesses in some areas, for examples: Automatic stations are not equipped with GSM / GPRS; problems in reception of real-time weather information to the Forecast Cell at DMN; dissemination of information done mostly by mail; no automation of production; timing of production and provision of information not sufficiently adequate; detection of storm genesis and storm cell monitoring products such as RTD not available.

The meeting noted that SODEXAM / DMN needs support to overcome various issues and to improve its forecasting and warning services in the areas of: training on NWP interpretation (for forecasters) and in running numerical weather prediction model; the reception, processing and broadcasting of the weather information in real time (e.g. SMS, etc.); development of new products, for example for health and hydropower energy sectors, and for climate services; the automation of certain routine tasks (tool mastery, application development, etc.); reconstruction of missing climate data in the Center-North-West zone (2003-2015); increasing collaboration between the DMN and partners (at national, sub-regional and international levels) to facilitate the development of new products and of the implementation of an integrated system allowing the automatic acquisition of data of the partner stations and; training tools such as CLIDATA, R etc.

**4.3.7 Mali**

Mr Moussa Toure informed the meeting that the National Agency of Meteorology of Mali is a Public Institution of an administrative character endowed with a moral personality and a financial autonomy. It is in a phase of institutional development and capacity building, coupled with the modernization of infrastructure and meteorological equipment. Efforts are also underway to improve communication and service delivery capabilities.

Some shortcomings are nevertheless to be emphasized, in particular related to the low number and quality of human resources in a context of increasing demand from users, resulting in limiting the Agency capability to respond to users’ needs. To remedy these shortcomings, it is expected that WMO continue its efforts to strengthen the capacities of NMHSs of its Members. It is also hoped that the SWFDP project will enable members to establish and strengthen an effective system of forecasts and warnings in consideration of the resurgence of extreme weather events.

**4.3.8 Senegal**

The representative of Senegal NMHS (ANACIM Senegal), Mr Mouhamadou Moustapha Kamara, highlighted the capabilities of ANACIM including in the areas of observations (in terms of meteorological stations, radar, automatic rain gauges, marine station etc.), human resource, forecasting products, equipment and licenses acquired. He provided information on different services and newsletters issued by the ANACIM and their various means of dissemination, notably through social networks, website, mobile application and by SMS. Senegal has its own alert thresholds and related bulletins. One of the most successful achievements includes the setting up of a multidisciplinary working group in most departments bringing together all the structures present in the department and whose work is closely linked to the progress of rainy season.

Senegal’s expectations from the SWFDP includes improvements to the Internet network, facilitation of acquisition of equipment and licenses; facilitating the implementation of MoU with the major Global Centers.

**4.3.9 Togo**

Mr Latifou Issaou indicated that the Togo NMHS prepares daily, weekly, monthly (climatological and agrometeorological) forecast bulletins and seasonal forecast bulletins (large and small rainy season). Alerts for extreme weather are also emitted by the forecasters who work 24/7. All these bulletins are distributed to the users and the different institutions.

To improve the distribution of weather bulletins and information, Togo NMHS needs: (i) a new media weather studio with a weather forecasting software on television; (ii) a website and (iii) a system for the dissemination of information through mobile phones.

Mr Issaou offered to host the next meeting of SWFDP-West Africa in Lome, Togo.

**5. ROLE OF RMSC DAKAR AND IDENTIFICATION OF GAPS**

The meeting noted that ,as part of the implementation of the Severe Weather Forecast Demonstration Project (SWFDP) in West Africa, the RSMC Dakar has initiated a process of upgrading its equipment and of building capacity of its staff with the help of its partners.

Mr Sadibou Ba, represented the RSMC Dakar and briefed the meeting on the status and plan of the RSMC Dakar. The meeting was informed that as part of of the SWFDP West-Africa, RSMC Dakar has initiated, with assistance of his partners, a process of upgrading its equipment and enhancing the capacity of its staff. Mr Ba’s presentation on efforts of ANACIM in terms of identifying gaps in meeting the needs of participating NMHSs focused in three areas:

1. the ANACIM vision and strategy of improving the quality of weather and climate services through activities such as the modernization of the observing network, the strengthening the capacity of staff through training, the implementation of weather/ climate models adapted to local conditions and the setting up of an information system;
2. the needs of the participating NMHSs, which can be summarized around access to new products from the World Meteorological Centers, other regional model products developed by RSMC Dakar, training, procurement of new observation equipment and guidance on severe weather events with the appropriate means of communication. The NMHSs presentations showed shortcomings in the areas if infrastructure, communication and limited human resources and;
3. proposals for responses from RSMC Dakar perspective: RSMC Dakar has set up a website (under development) dedicated to the SWFDP Website (<http://www.anacim.sn/meteo/rsmc-dakar/>).
4. RSMC Dakar can also offer training to some NMHSs on ECMWF products and Wavewatch3 outputs

The meeting noted the efforts in improving RSMC Dakar capacity through national resources and with support from various projects including SWFDP. However, the meeting also recognized the important potential role of RSMC Dakar as a lead regional centre within the framework of SWFDP-West Africa including for the issuance of Daily Regional Guidance product for the NMHSs and requested for continuing efforts enabling RSMC Dakar to play its role for SWFDP-West Africa.

**6. PUBLIC WEATHER SERVICES (PWS) : DELIVERY OF WARNING SERVICES**

Mr Samuel Muchemi introduced the scope of service delivery that the SWFDP-West Africa would seek to address in strengthening Members' capacities. The PWS Programme assists NMHSs deliver improved weather and related services to the public and specialized users for sound decision-making on public safety, quality of life and social and economic activities. He highlighted activities, under the PWS Programme, related to SWFDP in West Africa, including the issue around the implementation of the WMO Strategy for Service Delivery, the paradigm shift to move to impact based-forecasting and risk-based warnings, the adoption of the Common Alerting Protocol (CAP) in issuing warnings for ease of use by various dissimilation platforms (mobile apps, TV etc.). He also provided information on WMO registry for alerting authorities, a system providing aggregators, emergency managers and other intermediaries an authoritative register of organizations authorized to issue alerts in each country. Additional information on the above can be found in **Annex III.**

Mr Muchemi indicated that, Under the project, SWFDP Training for the Improvements in PWS will be conducted. Similarly, evaluation of PWS Programmes of NMHSs will be carried out in order to determine the existing gaps in service delivery. Funds allowing, activities will be carried out to bridge the gaps. These could include the establishment or improvement in communication channels such as websites, TV studios, Social Media, Mobile phone weather Apps, CAP systems as well as guidance on working with the media and Disaster Management and Civil Protection Authorities through the development of Standard Operating Procedures (SOPs) and Memorandum of Understanding (MoUs). Examples of such projects carried out in other regions are available at:

<https://public.wmo.int/en/projects/improving-dissemination-of-weather-forecasts-and-warnings-through-radio-and-television>

The meeting noted that a series of PWS publications are available at the following URL:

<http://www.wmo.int/pages/prog/amp/pwsp/publications_en.htm>.

**7. REPORTING MECHANISM AND FEEDBACK BY NMCs**

Mr Ata Hussain informed the meeting that NMCs/NMHSs participating in a SWFDP regional subproject are required to provide regular feedback including in the form of Quarterly Progress Reports after start of demonstration phase of the subproject. A SWFDP database using WMO's Country Profile Database (CPDB) platform (<https://www.wmo.int/cpdb/>) has been developed. The SWFDP database is password protected and can be accessed by the designated focal points for SWFDP in each NMHS by using his/her email address as username and after resetting his/her password.

The main objective of the SWFDP database is to facilitate the SWFDP participating countries to on-line submit their progress reports in an efficient and convenient (paper-free) way. The NMHSs’ feedback is not only important for improving monitoring and tracking of the subproject progress but it is also very relevant for participating and contributing centres to improve the overall forecasting and warning system. The information obtained can also be helpful in preparing feedback for the donors to secure necessary funds for the continuity and sustainability of SWFDP which is mainly supported through extra-budgetary resources.

The database was demonstrated to the participants on how to access to it and to provide information on various fields/screens including on verification of forecasts/warnings, usefulness of NWP products and guidance, clients feedback and case studies etc. A template of the quarterly progress report is provided in the draft Regional Subproject Implementation Plan (RSIP) of SWFDP-West Africa.

**8. DEVELOPMENT OF RSIP FOR SWFDP-WEST AFRICA**

Considering outcomes of the inception meeting in Dakar, Senegal in 2015 and subsequent activities, the meeting considered and reviewed the outline of the draft Regional Subproject Implementation Plan (RSIP) of SWFDP-West Africa and developed the RSIP taking into account the guidelines as provided in SWFDP Guidebook.

The meeting held several brainstorming sessions including on NWP products requirements, responsibilities of participating global, regional and national centres, review of national thresholds for the issuance of forecasts and warnings and development of regional thresholds to be used by RSMC Dakar for the issuance of Daily Guidance product, training and capacity development needs of NMHSs, capacity of RSMC Dakar etc. The meeting agreed on the subproject domain to be bounded by 0°N to 35°N and 30°W to 25°E for monitoring, analyzing and prediction of severe weather events. The draft RSIP developed by the meeting is available as a separate document. Its final version will also be uploaded on WMO website at the following link:

http://www.wmo.int/pages/prog/www/swfdp/index\_en.html

**9. MAJOR ACTIONS AND NEXT STEPS**

Based on capacity development needs of NMHSs in improving forecasting and warning services and discussions on development and implementation of SWFDP-West Africa, the meeting agreed to the following activities:

* Chair of RSMT to update the RSIP of SWFDP-West Africa in collaboration with all NMHSs/centres and with assistance from WMO Secretariat
* WMO Secretariat to send the RSIP to all relevant/potential contributing centres global and regional centres for review and agreement
* Development, availability and accessibility of requested NWP including EPS products from potential contributing global and regional centres including RSMC Dakar and ACMAD
* Provision of nowcasting guidance products (e.g. RDT etc.) including by Meteo France and training of NMHSs in nowcasting
* ACMAD to conduct study in collaboration with RSMC Dakar and NMHSs on relationship of dust load data (as available through WMO SDS-WAS centres e.g. Spain) and visibility data over West Africa to develop visibility thresholds based on dust load for the issuance of guidance
* Provision of Daily Severe Weather Forecast Guidance Product by RSMC Dakar
* Capacity development of NMHSs
* SWFDP training workshop on NWP/EPS products usage and interpretation before start of Demonstration phase
* Provision and/or improvement of TV weather studios where necessary and training of NMHSs on collaboration with media and DMCPAs.
* Introduction and Strengthening of impact based forecasting and warning services at NMHSs
* Implementation of CAP
* Enhancement of the SWFDP database for on-line quarterly reporting by NMHSs in West Africa

The following table summarizes key follow-up activities with responsibilities and time frame to facilitate preparatory work for start of demonstration phase.

|  |  |  |
| --- | --- | --- |
| **What?** | **Who ?** | **When** |
| Finalize RSIP | President RSMT/ WMO Secretariat | 13 October 2017 |
| Complete further development of the RSMC Dakar website | RSMC Dakar/ WMO Secretariat | 31 December 2017 |
| Development of NWP products | Global centres | 31 March 2018 |
| Training workshop (depending on the availability of funds) | WMO Secretariat | Q2 2018 |
| Pilot Demonstration phase begin | All | Q3 2018 |
| Submission of first Quarterly Progress Report | NMHSs | Q4 2018 |

**10. REVIEW OF THE MEETING REPORT**

The meeting reviewed and adopted the report

**11. CLOSING**

The Technical Planning meeting on the Implementation of Severe Weather Forecasting Demonstration Project (SWFDP) in Western Africa closed at 13:00 hours on Friday, 8 September 2017. Before its closure, the meeting also thanked and appreciated the representative of Togo for his offer to host the next meeting of SWFDP-West Africa in Lomé, Togo.

**Annex I**

**AGENDA**

**1. OPENING**

**2. ORGANIZATION OF THE MEETING**

2.1 Adoption of the agenda

2.2 Working arrangements

**3. SEVERE WEATHER FORECASTING DEMONSTRATION PROJECT (SWFDP) FRAMEWORK**

3.1 SWFDP Guidebook for Planning Regional Subprojects (2016 version) and

overall framework including requirements from participating centres, project management and sustainability

3.2 Summary of the inception meeting in Dakar, Senegal (November, 2015)

**4. SWFDP’s CASCADING FORECASTING PROCESS:**

4.1 Roles of Global Centres and products availability: Meteo-France, ECMWF,

US NOAA/NCEP

4.2 Roles of Regional Centres and of a few advanced NMHSs: Morocco, Nigeria, RCC ACMAD and AGHRYMET

4.3 National Meteorological Centres (NMCs): update operational systems capacity, needs and ongoing projects

**5. ROLE OF RMSC DAKAR AND IDENTIFICATION OF GAPS**

**6. PUBLIC WEATHER SERVICES (PWS) : DELIVERY OF WARNING SERVICES**

WMO Strategy for Service Delivery, impact based forecasts and warnings, and use of Common Alerting Protocol (CAP)

**7. REPORTING MECHANISM AND FEEDBACK BY NMCs**

(e.g. Submission of regular Progress Reports by NMCs including on Verification of Forecasts, Case Studies, Users’ Response etc.)

**8. DEVELOPMENT OF RSIP FOR SWFDP-WEST AFRICA**

8.1 Products/Data to be shared: Brainstorming Session on NWP

8.2 Products/Data to be shared: Brainstorming Session on Observations and other relevant information

8.3 Guidance Products for NMCs: Brainstorming Session on Guidance Products (incl thresholds for warnings)

8.4 Development and Review of draft RSIP for SWFDP-West Africa

**9. MAJOR ACTIONS AND NEXT STEPS**

**10. REVIEW OF THE MEETING REPORT**

**11. CLOSING**

**Annex-II**

**List of Participants**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr#** | **Country/ Organization** | **Name & Affiliation** | **Contact details**  **(Tel., Fax, Email)** | **Photograph** |
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**Annex III**

**ADDITIONAL INFORMATION ON PWS PROGRAMME ACTIVITIES**

1. **The WMO Strategy for Service Delivery**

Under SWFDP, the WMO Strategy for Service Delivery will be implemented. The Strategy is a tool to assist NMHSs to significantly improve their capacities and capabilities to deliver services to the public, social and economic sectors including the Disaster Management and Civil Protection Agencies (DMCPAs), the media, health, energy etc. It was approved by the Sixteenth Session of Congress (Cg-16). The Service Delivery Progress Model (SDPM), of the Strategy is a practical tool that will enable NMHSs participating in the project to assess their current service delivery levels and to develop plans to improve them to higher levels. In order to understand the Strategy, NMHSs are invited to download and read the “WMO Strategy for Service Delivery and its Implementation Plan”. The publication is available in several languages including English and French at the following link:

<https://library.wmo.int/opac/index.php?lvl=notice_display&id=16002#.Wbznf7IjHIU>

1. **Impact-Based Forecasting and Risk-Based Warning**

The Project will seek to introduce or improve impact-based Forecasting and Risk-Based Warning in the NMHSs of participating countries. Impact-based warnings provide information of how hazards may impact warning recipients. This is because despite the fact that NMHSs issue accurate hazard warnings populations do still suffer many casualties and damage because of lack of knowledge of likely impacts of the hazard. An NMHS cannot deliver impact-based warning services on its own but rather need to closely coordinate with different organizations that process disaster risk exposure and vulnerability data.

The benefits of an Impact Warning Service include:

* Relays a message to enable those at risk to take appropriate actions
* Improved planning for different scenarios based on different impacts
* Contains information about the level of confidence in the forecast for better decision-making
* Provides basis for post-event analysis of multi-hazard impacts to assist in planning, response and mitigation of impacts
* A comprehensive and coordinated process to address disaster response and preparedness

NMHSs are invited to download and read the «WMO Guidelines on Multi-hazard Impact-Based Forecast and Warning Services» published by the Public Weather Services (PWS) Programme. It provides a roadmap to assist members develop impact-based warning services and defines the necessary steps and explains likely levels of complexity.

1. **The Common Alerting Protocol (CAP)**

The Common Alerting Protocol (CAP) is an Extensible Markup Language (XML) international standard for coding documents in a format that is both human- and machine-readable. Its coded values enable automation of filtering, routing, and translation of messages to human languages. It is a standard format for emergency alerting designed for “all-hazards” and “all-media” e.g. cell phones, faxes, radio, television, digital communication networks. It enables simultaneous communication of alerts over many different alerting systems, thus increasing effectiveness while simplifying the alerting task. Cg-15 endorsed adoption of a warnings Standard such as CAP for alerting. WMO through PWS programme assists Members to implement CAP and will form part of the activities of the SWFDP-West Africa. More information is available at:

https://www.wmo.int/pages/prog/amp/pwsp/CommonAlertingProtocol\_en.html

1. **WMO Register of Alerting Authorities**

The WMO Register of Alerting Authorities provides aggregators, emergency managers and other intermediaries an authoritative register of organizations authorized to issue alerts in each country. Permanent Representatives of Members with WMO nominate editors to maintain respective country register pages. For every alerting authority the Register shows the Object Identifier (OID), Hazard categories authorized, The CAP URL, Forecasts URL and Alerting Area. Under the SWFDP, participating countries will be guided on how to effectively register themselves on the Register. More information is available at:

<https://alerting.worldweather.org/>

1. **Participation of Members in the World Weather Information Service (WWIS)**

The WWIS is a centralized source of official weather by NMHSs for international media, tourism and the public. It is designed to enhance the visibility of NMHSs, especially those of developing countries. The opportunity offered by the SWFDP will be used to enhance the participation of beneficiary countries in the WWIS. More information is available at: <http://worldweather.wmo.int/en/home.html>