

COUNTRY HYDROMET DIAGNOSTICS

Liberia 2021 peer review



Peer Reviewer
Nigerian Meteorological Agency



COUNTRY HYDROMET DIAGNOSTICS

Informing policy and investment decisions for high-quality weather forecasts, early warning Systems, and climate information in developing countries



Liberia Report

Peer reviewed by Professor Mansur Bako-Matazu
Nigerian Meteorological Agency

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INTRODUCTION

Global threats and challenges related to climate change and the impact of extreme weather and climate events are rising, and demand to provide high-quality weather, climate, hydrological, and related environmental information services - referred to as HYDROMET - is rapidly increasing. Despite the urgency and substantial investments in strengthening developing country hydromet capacity, difficult challenges remain in monitoring and tracking performance of public meteorological services in an easy understandable and coherent manner.

Countries in the African region have never been more vulnerable to the climate change impacts than at present, forcing them to continually adjust national development programmes at considerable costs. Most countries or sub-regions are increasingly prone to floods, droughts, heatwaves and storms resulting into food shortages. Water for economic activity, drinking and livestock is becoming increasingly scarce. Dust storms are increasing in frequency, with associated health problems. There has been a resurgence of weather and climate-sensitive diseases in some countries and an increase in the geographic spread of epidemics like malaria and cholera. Rift valley fever, which was eradicated over fifty years ago, is now reoccurring. These changes are happening against the backdrop of increasing population on the continent.

The [Country Hydromet Diagnostics](#) responds to the need for a standardized, integrated and operational tool and approach for diagnosing National Meteorological Services, their operating environment, and their contribution to high-quality weather, climate, hydrological and environmental information services and warnings. The Diagnostics is an umbrella tool that draws on and adds value to existing WMO assessment material by synthesizing existing approaches and data into an easily interpretable form, validating the information provided by WMO Members through a peer review process, and obtaining missing information.

The Diagnostics assessment therefore aims at informing policy and investment decision-making, in particular guiding investments of the [members of the Alliance for Hydromet Development](#). The Alliance brings together major development and climate finance partners behind a joint commitment to strengthen developing country hydromet capacity. Through the Diagnostics, developing countries are expected to benefit from better targeted and aligned financial and technical support.

The Country Hydromet Diagnostics is based on the ten most critical elements of the hydromet value cycle, grouped under four categories – *enablers*, *observation* and *data processing system*, *service*, *product production and dissemination*, and *user and stakeholder interaction*. For each value cycle element, a limited number of standardized indicators are used, and each indicator uses explicitly defined data sources. The Assessment of these critical elements of the National Meteorological Service should lead to their maturity level. Please note that Level 5 is the highest attainable maturity level in this CHD assessment.

The Diagnostics draws as much as possible on primary data (self-reported and other sources of quantitative data), but to inform the peer review used additional data, in particular data from country user/client surveys. The WMO Needs Assessment Mission Report to Liberia provided baseline data. While WMO Community Platform provides the primary source of data information requirements for the Diagnostics and the results of the Diagnostics will be integrated in the Platform adding substantial value.

Decades of low investment in public sector institutions, coupled with fourteen years of civil war has completely disrupted the meteorological and hydrological services of Liberia. Hence the capacity to observe, monitor, forecast, package and communicate information products/services on the various states of the climate and surface water resources is significantly diminished.

In this vein, a draft prototype of the CHD has been developed for Liberia, a developing country in West Africa recovering from one and a half decade of war, which has been identified to test drive the Diagnostics. **Liberia** is located at 6 °N, 9 °W. It borders the north Atlantic Ocean to the southwest (580 kilometers (360 mi) of coastline) and three other African nations on the other three sides, **Sierra Leone** to the northwest, **Guinea** to the northeast and **Ivory Coast** (Côte d'Ivoire) to the east. In total, Liberia comprises 110,000 square kilometers (43,000 sq mi) of which 96,300 square kilometers (37,190 sq mi) is land and 15,000 square kilometers (5,810 sq mi) is water (see fig. 1).



Figure 1: Map of Liberia

To conduct the assessment of the critical elements of the hydro-meteorological value chain, the Nigerian Meteorological Agency (NiMet) has agreed to assist in this CHD. In addition to the Country Information on the WMO Community Platform available in the database, a structured questionnaire was adopted based on the indicators of the CHD. This was combined with feedbacks from virtual meetings by critical staff members of the Liberia Meteorological Service (LMS). The Climate Services Checklist as well as the WMO Mission Report on Needs Assessment were also intensively reviewed. Even though both LMS and Liberian Hydrological Service were consulted in the course of this assignment, the focus of this report is only limited to the Liberia Meteorological Service.

This report is presented along the ten most critical elements of the hydro-meteorological value cycles with an indication of their respective maturity level informing where additional focus and support is needed (based on the assessment of the indicators) and some high-level recommendations offered to aid uplift that maturity level.

I. GOVERNANCE AND INSTITUTIONAL SETTING

In Liberia, hydro-meteorological services are provided by two Services: Meteorological Services are being provided by Liberia Meteorological Service (LMS) while Hydrological Services, by the Liberian Hydrological Service (LHS). This CHD assessment however focuses on the Liberia Meteorological Service (LMS).

- 1.1 Liberia Meteorological Service lacks knowledge of current climate and water threats and is also poorly prepared for future climate- and water-related impacts. These capacity deficits in the national meteorological and hydrological sectors have particularly negative impacts on rural Liberian communities, the majority of whom are small-scale farmers and are highly dependent on natural resource-based livelihoods. In the urban areas, poor infrastructure and poor planning constitute major threats to communities with exposure to climate-related and water-borne diseases and other negative impacts threatening lives, livelihoods and property.
- 1.2 LMS does not have an existing strategic, operational or risk management plans. And up to the time of the assessment, LMS does not generate data nor perform any other functions in relation to their mandate and the staff component though seemingly well-trained lacks the operational environment to apply their skills.
- 1.3 LMS does not currently have a budgetary allocation for operations and procurement of necessary supplies, and is currently domiciled as a unit within the Ministry of Transport (MOT). Annual salaries of the LMS personnel stand at USD 54,168.48.
- 1.4 Despite the absence of budgetary allocation, the LMS consists of the following sixteen staff whom receive salaries from the MoT: A Director, Assistant Director, Research officer, Weather Forecaster, retired Physical Geographer, three (3) Agromet technicians, Data Clerk, Secretary, Meteorological Observer, Office Assistant and four (4) Students (Instrument Technician, File Clerk, Meteorological Observer and Agromet technician). All these categories of staff do not benefit from any form of training or capacity building on operations or ICT. **Details on table 1.**
- 1.5 It should be noted that the initial process of transforming LMS into an Agency has been abandoned. Currently, Liberia is working on developing a Bill to merge the LMS and LHS as one agency to be called “Liberia Hydromet Agency” (LHA). The EPA and UNDP-Liberia in consultation with LMS/MoT and LHS/MME have finalized a ToR to hire a national consultant to perform this task. Please be informed that EPA will be hosting a 5-year GCF/CDSF funded Project under AfDB targeting LMS, LHS, NDMA and EPA and the development of this Bill is one of the key deliverables. The EPA is now fast-tracking this deliverable under UNDP funding
- 1.6 Management of the GEF-funded Early Warning System project even though in the Ministry of Transport (MOT), but the MOT Project Manager is not part of LMS. This shows a significant disconnect in this project which meant that the project was

delivering systems which were of questionable utility for climate risk analysis or for forecasting on timescales from seasonal to sub-daily in Liberia.

Based on the above assessment using the tools of the CHD, the Governance and Institutional setting element of the hydro-met value cycle has been set to **Maturity Level 2** basically because of lack of clear budgetary provisions and complete absence of the Strategic Operational Plans and Policies. The Director LMS Should strive to liaise with the MOT to fast track the passing of the LMS Act by the Parliament. He should work with senior managers on organizational strengthening, strategic and operational planning and setting up of Quality Management System in a process driven structure. These when implemented will help lift up the maturity level for effective performance and improved service delivery of the LMS.

| No. | Name | Position | First Degree | Major | Minor | Advanced Degree |
|-----|------------------------|-----------------------|---------------------|------------------------|-----------------------|-----------------|
| 1 | Arthur Gar-Glahn | Director | BSc | Physics | Mathematics | MSc (Met.) |
| 2 | Albert M. Sherman | Assistant Director | BSc | Mathematics | Physics | PGD (Met.) |
| 3 | Eugene V. S. Gar-Glahn | Research Officer | BSc | Mathematics | Physics | PGD (Met.) |
| 4 | Henry A. Simpson | Weather Forecaster | BSc | Chemistry | Biology | None |
| 5 | Jerome D. Kay* | Physical Geography | BA | Geography | History | None |
| 6 | Princess M. Tarpeh | Agromet. Technician | BSc | Agronomy | N/A | None |
| 7 | J. Leviticus Kollie | Agromet. Technician | BSc | Agriculture | N/A | None |
| 8 | Spencer S. Taylor | Agromet. Technician | BSc | Agriculture | N/A | None |
| 9 | Abdullah C. Conneh | Data Clerk | BSc | Economics | Demography | None |
| 10 | Edward J. Chenny | Secretary | BA | Sociology | Public Administration | None |
| 11 | Amos G. Yloe | Met. Observer | BTh | Theology | N/A | None |
| 12 | James Kollie | Instrument Technician | Student | Electrical Engineering | N/A | None |
| 13 | Jason T. Nyankoon | File Clerk | Student | Sociology | Management | None |
| 14 | Olinga S. Flomo | Agromet. Technician | Student | Accounting | Management | None |
| 15 | Georgia K. Walker | Met. Observer | Student | Accounting | Economics | None |
| 16 | Jestina Dube Thompson | Office Assistant | High School Diploma | N/A | N/A | None |

Table 1: Staff list at Liberia Meteorological Service (LMS)

II EFFECTIVE PARTNERSHIPS TO IMPROVE SERVICE DELIVERY

21. LMS participates in the PRESAGG Seasonal Forecasting workshops before the commencement of the hydrological growing season. LMS does not currently participate in other regional programs such as: Vigilance Project (ACMAD) and SWFDP West Africa. LMS do not seek or follow up invitations to participate in programs of which the Director was aware. However, the World Bank (WB) Country Office completed the country partnership framework within its public sector reform portfolio. On its part, the African Development Bank (AfDB) was able to review the country needs for modernizing hydromet services which was presented through the Country Strategic Partnership.
22. The WIGOS focal point in LMS did not seem to be aware of messages from the WMO WIGOS office. Also, partnership with private sector, academia and research centres is in fact very limited. There is almost absence of joint research and innovation projects.
23. There is lack of coordination and partnership across the institutions producing hydromet information with those needed products, services and application for civil protection. This requires the LMS to facilitate consultations in order to find and develop a national mechanism for shared generation and use of climate, water and weather information.
24. The Early Warning project which is financed by the GEF/LDCF through UNDP within which the UNDP has contracted the Earth Networks company to install Automatic Weather Stations on mobile phone towers as well as some ground stations.
25. Liberia lacks a fully operational forecasting system to develop a variety of products and services responding to its partners'/users' needs. LMS currently has little capacity to deliver weather services. Until the merger with the Aviation Weather Service, there is very little information or skill to produce forecast services.

Sequel to the aforementioned, it was believed that the **maturity level** of LMS is placed at **Level 2**. To raise this level up, it is recommended that LMS, LHS and the respective authorities of their ministries to evaluate the GEF/LDCF project and place the role of the Early Warning Project within the context of the respective roles of LMS and LHS and to ensure that: the Early Warning Project be conducted under the authority of LMS; the role of LMS as the originator of public warnings for Liberia be preserved; all metadata concerning the stations should be disclosed to LMS, and all observational data should be handed over to LMS for inclusion in the National Climate Database, both past and real-time data for products generation. Also, agree and implement partnership/co-operation arrangement between NDMA and LHS as well the Liberia Disaster Management Agency for effective climate early warning service delivery.

III OBSERVATIONAL INFRASTRUCTURE

- 3.1 The observational structure of the Liberia Meteorological Service is presented as follows:
- a. There are two sites at Roberts International Airport (RIA). One is the briefing room in the terminal building. The other is the forecast/observing building which is near the control tower. The LMS at RIA has not started to implement a Quality Management System, though other sections are producing documentation. At James Spriggs Airport, Sinkor, Monrovia, there is an observing program;
 - b. There is no existing ground observation station in Liberia. Eight out the Eleven Automatic Weather Station (AWOS) are operational but none transmit to GTS/WIS.
- 3.2 There are two Stevenson screens outside the office. The exposure is good, but grass has not been recently cut; there is no enclosure, and no rain-gauges, grass thermometers or bare-soil area. One of the screens is derelict, the other is missing some slats from the radiation shield and is dirty.
- 3.3 Davis Vantage Pro low-cost Automatic Weather Station (AWS) is installed on the roof. This works, but cannot be regarded as a suitable system for METAR or Synoptic observing. Exposure is poor; the cup anemometer was off-vertical and seemed to be under-reading.
- 3.4 Whenever the Internet is working, the staff appear to monitor the Earth Networks AWS mounted on a cell-phone tower on the Tubman road, about 5 km away. NOTE this is not suitable for METAR or SYNOP.
- 3.5 Pressure: the station barometer has been removed from the observing office. There was no information about when this was last calibrated, but probably outside the allowed period. It is not clear what barometer is being used for the METAR and QFE.
- 3.6 There is a small anemometer mounted on the roof to measure wind speed, which does not appear to be connected to anything.
- 3.7 The only functioning rain-gauge is a simple post-mounted gauge on the roof of the building. This is a seriously non-standard exposure, especially as the post to which it is attached continues up to a radio antenna, and other adjacent structures. This will cause random errors, in addition to likely underestimates from the airflow round the building.
- 3.8 The LMS has no existing Standard Operating Procedure for either deployment, or maintenance, quality assurance or calibration of the equipment.

Considering the above treatise, the Maturity level of the observational infrastructure at LMS is assessed to be **Level 1 due to limited number of observation infrastructure.** This Status could be improved once the 11AWS are fully operational, and their data are seamlessly transmitted through the GTS, and also provide enough funds for the training of staff and maintenance of equipment. Development of a five-year strategic master plan for effective observation which will set the priorities based on specific internal and external demands of LMS and to the major available technological choices will also help lift the maturity level.

IV. DATA AND PRODUCTS SHARING AND POLICIES

- 4.1 The LMS has no functional ground-based observation stations and upper air stations, and even the 11 AWS are not registered with the WIS and currently does not transmit data to the WMO WIS/GTS Platform.
- 4.2 There is no existing formal policy and practice for free and open sharing of observational data in Liberia. International data reception is very limited due to a lack of adequate operational system (workstations, telecommunication system, Internet).
- 4.3 Presently, LMS does not have access to external data sources on national, regional and global context either in form of satellite data or NWP models.
- 4.4 The LMS currently has no Climate Database Management System (CDMS). It has a limited amount of rain-gauge. LMS should implement a CDMS which is compliant with WMO standards, as the climate element of the National Statistical Database.

The **maturity level** of the Data and Products Sharing and Policies is, therefore, assessed and put at **Level 1** due to non-availability of data sharing infrastructure and lack of data sharing policy and practice in Liberia. Concerted efforts geared up to develop national regulations that govern the measurement, sharing and use of meteorological data. LMS should implement a CDMS which is compliant with WMO standards, as the climate element of the National Statistical Database. This could be done by requesting help through WMO. The World Bank indicated that they are currently scoping a project to rebuild the National Statistical Database and would welcome adding the National Climate Database to this.

V. NUMERICAL MODEL AND FORECASTING TOOL APPLICATION

- 5.1 LMS does not use any model outputs and remote sensing products for running forecast. The forecasters were in fact, not aware of products from ECMWF, NCEP or the UK Met Office Africa web viewer.
- 5.2 The Service does not have the internal ability and capability to run and maintain a forecasting model of its own.
- 5.3 Since there is absence of operational forecast office at LMS, probabilistic ensemble predictions at any time-scale are not being conducted currently.
- 5.4 Without the Internet link, it was not possible for the forecasters to obtain information from any of the available Internet sources.
- 5.5 LMS does not currently participate in other regional weather and climate outlook programs such as: the Vigilance Project (ACMAD) and SWFDP West Africa.
- 5.6 Currently, NiMet provides to LMS the Liberian Daily Weather Forecasts (including the tv studio telecasting) using the available NWP products. NiMet reported lack of feed backs from the Service to ascertain the skills and performance of the daily forecast.

The **maturity level** for this critical element is assessed **at Level 1** principally due to total absence of even the classical forecasting techniques at LMS. To improve on the maturity level, LMS should consider the necessity to engage, through external funding as necessary, an expert to mentor the staff of LMS in the process of producing forecasts and services. Enable a staff member to lead on high-impact weather events, especially flood risk mapping and establishing thresholds and also broadcast the daily weather forecast generated by the Nigerian Meteorological Agency (NiMet).

VI.

WARNING AND ADVISORY SERVICES

- 6.1 LMS does not have a 24/7 warning services in place due to absence of a single forecaster in the service, and lack of operational forecasting infrastructure: (workstations, telecom system and internet service).
- 6.2 There is a lack of well trained and qualified staff, facilities for training and in some cases basic equipment to generate forecasts and issue early warning alerts.
- 6.3 The LMS does not participate in any Regional Climate Outlook (PRESSAG and SWFDP) to downscale forecast at country level.
- 6.4 LMS heavily relies on NiMet to generate and issue Early Warning/Alerts which are in most cases not being utilized.
- 6.5 Considering that there are no warning services provided by LMS, there was therefore no attempt to implement the Common Alerting Protocol (CAP) and impact-based forecast and risk-based warning in Liberia.

This component is assessed as **Maturity Level 1. To uplift this maturity level** as a matter of urgency, the NiMet TV product be aired daily as LMS prepares itself to produce its own TV weather presentation bulletins. On this, LMS will need to construct a TV weather presentation studio inside the National Meteorological Centre (NMC) building that is currently under extension at the airport. In order to manage the flow of risk information available in the country, both with regard to hazards (flood and landslides) and exposure of populations and infrastructure, there is need to have an inter-ministerial coordinating committee, with responsibility for addressing and communicating climate and weather-related emergencies.

LMS should also enter into discussions with LBS and other radio stations to agree on modalities for providing weather forecasts for airing on radio so that this service would commence as soon as LMS started producing forecasts, either as scripts or sound files. Capacity should be developed for providing weather bulletins through social media (Facebook, YouTube, etc.).

VII

CONTRIBUTION TO CLIMATE SERVICES

- 7.1 The LMS do not provide even the basic climate service to the citizens of Liberia.
- 7.2 Liberian policymakers, planners, investors and ordinary citizens will need climate information so that they can prepare for expected trends and changes.
- 7.3 LMS currently have a staff member specializing in agro-met services; the function of this person should be to establish working relationships with relevant Ministry of Agriculture staff, and to agree, design and implement suitable products.

The maturity level is assessed at **Level 1** due to absence of even basic climate service being provided to the public in Liberia. The maturity level could be improved if climate database, historical data/documents management systems are in place and other services are provided to other sectors such as DRR/Environment, Health, Transportations, and Construction etc. The first step is for LMS to nominate a staff member to specialize in managing the National Climate Database. This person could then be trained and assisted to set up the CDMS by an expert, as well as assisted to collect and incorporate data from existing databases, such as the IPCC dataset, NCDC, and national data managers, including LHS (through a data sharing and exchange agreement).

LMS should, as a matter of urgency, nominate a staff member to lead on high-impact weather services. The first step is to establish working relations with LDMA. Given that floods are the highest priority cause of disasters, a collaborative effort by LMS and LHS should establish flood risk maps and thresholds for rainfall events likely to cause flooding. These thresholds should be fed into the risk mapping under the SWFDP West Africa.

In keeping with modern demand by the public for easy access to information provided over multiple channels of communication including mobile devices, it may be advisable to develop capacity to deliver warnings in the Common Alerting Protocol (CAP) format which allows simultaneous communication of a warning over different communication channels. It will also make it possible for warnings provided by LMS to be aggregated for sharing on the WMO Global Multi-hazard Alerting System (GMAS).

VIII

CONTRIBUTION TO HYDROLOGY

- 8.1 There was currently no exchange of data or products between LMS and LHS.
- 8.2 The LHS present objectives was water resources for hydro-electric generation.
- 8.3 No forecasting products are generated or provided at this stage.
- 8.4 There is no any Standard Operating Procedure (SOP) for the exchange of information between LMS and LHS or NDMA and no common database to hold and exchange information between these departments.
- 8.5 Non-availability of real-time data for flood warnings, and no assessment of flood related risks, determination of flood threshold levels, flood mapping, warning mechanisms

Considering the above treatise, the **maturity level** has been assessed as **Level 1** principally because LMS do not any input in terms of data or products to hydrology and water resources management in Liberia. Since there is no flood risk mapping or threshold data for Liberia. This work should be started as soon as possible to uplift the maturity level, noting that such activity spans the boundary between LMS and LHS. It was noted that LHS does not currently have resources for this, though they hold relevant data. LMS have a staff member who is interested in undertaking this work. It is suggested that he be tasked to undertake it working closely with LHS.

IX

PRODUCT DISSEMINATION AND OUTREACH

- 9.1 LMS does not have a TV studio and therefore do not any platform to disseminate forecast products. It doesn't have a website on its own to help with disseminating its information.
- 9.2 The Agency doesn't have an outreach program of its own even though NiMet generate and transmit the daily weather forecast bulletin to LMS.
- 9.3 There is no communication channel whatsoever to reach the high impacts weather vulnerable communities in Liberia.

Following the above, the **maturity level** is assessed at **Level 1** due to absence of even the traditional channels of forecast dissemination to public. To uplift the assessed maturity level of this critical element, there is need for urgent action on the present daily TV weather presentation bulletins prepared for Liberia by the Nigeria Meteorological Agency which are not aired. Discussions between the WMO Team and the Liberia Broadcasting System (LBS) on the one hand, and between the Team and LMS on the other resulted in the agreement that this product be aired daily as LMS prepares itself to produce its own TV weather presentation bulletins.

LMS should enter into discussions with LBS and other radio stations to agree on modalities for providing weather forecasts for airing on radio so that this service would commence as soon as LMS started producing forecasts.

LMS will consider and discuss with potential users who would benefit from warning services delivered through mobile phones. These could include fisher-folks and farmers, for example. Implementing such services for fishermen, for instance, would need the effort to create a framework for collaboration and coordination between LMS, a mobile phone service provider, donor(s), the fisher community, local leadership, rescue service providers, marine authorities, etc.

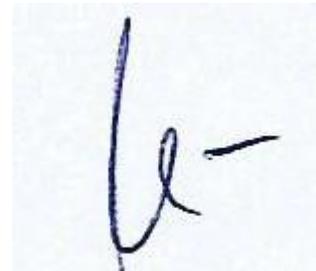
X. USE AND NATIONAL VALUE OF PRODUCTS AND SERVICES

- 10.1 The LMS lack any formal process for conducting feedback surveys and does not have a stakeholder platform for co-designing services with users. This scenario is particularly difficult considering that there is no operational forecasting activities in the service.
- 10.2 Following the critical operational situation at LMS and the Lack of annual budgetary provisions, there was never independent users' satisfaction surveys that has been performed and there is no immediate or medium-term plan do so in the nearest future.
- 10.3 One area where there remains a strong call for attention is in re-balancing the ownership and responsibility for climate services from provider-led and user-informed, to practices of co-exploration, co-design, co-development where providers and users of weather and climate services have more equal voices.

The maturity level of this critical element is assessed as **Level 1** mainly because LMS lacks any routine stakeholder feedback practice. Even the forecasting service being produced by NiMet is not being officially acknowledged neither providing feedbacks for improved service delivery. To uplift this maturity level, there is need for LMS to formalize a periodic platform to engage forecast users in order to co-design and improve service delivery. The conduct of an independent user satisfaction surveys will also help improve service delivery and win the confidence of the Liberian citizens.



Reviewer: Prof. M.B. Matazu (NiMet)
Nigeria



Endorsement: Director, LMS
Liberia

Summary of the Assessment and key Recommendations to lift up the Maturity Levels

| Maturity level | Element of the Value Cycle | Key Recommendations to lift up the Maturity level |
|----------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | Governance and Institutional Setting | <ul style="list-style-type: none"> ● Develop Liberia Hydromet Agency (LHA) Act for passage by Parliament ● Initiate process to appoint expert(s) to strengthen institutional framework ● Develop LMS Strategic Impact Plan ● Train Staff on Quality Management Systems ● Commence process to acquire ISO: 9001:2015 |
| | Effective Partnerships to improve service delivery | <ul style="list-style-type: none"> ● Agree and implement cooperation arrangements between LMS, Liberian Hydrological Service and NDMA ● Seek and develop partnerships with International Climate and Development partners, such as AfDB, GEF etc. ● The GEF/LDCF project on Early Warnings to be conducted under the Authority of LMS |
| 1 | Observational Infrastructure | <ul style="list-style-type: none"> ● Ensure the existing 11 AWS are functional and transmitting data to GTS ● Identify and arrange funding for more AWS ● Develop a National observation plan in accordance with WIGOS including Staff training |
| | Data and Products Sharing and Policies | <ul style="list-style-type: none"> ● Decide on CDMS available Systems and populate with historical data from NCDC, GCOS, LHS, etc. ● Add META data for Earth Network Stations ● Develop a data Policy for |

| | |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Supply of Climate data |
| Numerical Model and Forecasting Tool Application | <ul style="list-style-type: none"> ● Repair the existing ● Repair internet access ● Develop specification for new products ● Request WMO to assist with access to e.g., 10-day NWP products |
| Warning and Advisory Services | <ul style="list-style-type: none"> ● Determine and implement technical requirements to enable routine productions of products/Services ● Develop and strengthen relationships with partner organisations, especially LTA and other media organisations ● Implement a TV weather presentation Studio with assistance of WMO |
| Contribution to Climate Services | <ul style="list-style-type: none"> ● Develop capacity to deliver warnings in the Common Alert Protocol (CAP) ● Develop and implement Climate Services Plan ● Establish flood risk maps and thresholds for rainfall events |
| Contribution to Hydrology | <ul style="list-style-type: none"> ● Establish Strong collaborations with the LHS ● Work with LHS to start issuing National Flood Outlook |
| Product Dissemination and Outreach | <ul style="list-style-type: none"> ● Formalise the relationship with NiMet on Forecast Dissemination ● LMS |

Glossary

| | |
|---------|-----------------------------------------------------------------|
| ACMAD | African Centre of Meteorological Application for Development |
| AfDB | African Development Bank |
| AWOS | Automatic Weather Observing System |
| AWS | Automatic Weather Station |
| CAP | Common Alerting Protocol |
| CDMS | Climate Database Management System |
| CHD | Country Hydromet Diagnostics |
| DRR | Disaster Risk Reduction |
| ECMWF | European Centre for Medium Range Weather Forecast |
| GEF | Global Environmental Facility |
| GMAS | Global Multi-hazard Alerting System |
| GTS | Global Telecommunication System |
| ICT | Information and Communication Technology |
| IPCC | Intergovernmental Panel on Climate Change |
| LBS | Liberian Broadcasting System |
| LDCF | Least Developed Countries Fund |
| LHS | Liberian Hydrological Service |
| LMS | Liberian Meteorological Service |
| METAR | Meteorological Aerodrome Report |
| MOT | Ministry of Transport |
| NCEP | National Centres for Environmental Prediction |
| NDMA | National Disaster Management Agency |
| NiMet | Nigerian Meteorological Agency |
| NMC | National Meteorological Centre |
| NWP | Numerical Weather Prediction |
| PRESAGG | Regional Climate Outlook Forum for the Gulf of Guinea Countries |
| QFE | Atmospheric Pressure at Aerodrome elevation |
| SWFDP | Sever Weather Forecasting Demonstration Project |
| SYNOP | Surface Synoptic Observations |
| UK | United Kingdom |
| UNDP | United Nations Development Programme |
| WB | World Bank |
| WIGOS | WMO Integrated Global Observing System |
| WIS | WMO Information System |
| WMO | World Meteorological Organisation |

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