COUNTRY HYDROMET DIAGNOSTICS

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

June 2026

Sierra Leone Peer Review Report

Reviewing Agencies: Deutscher Wetterdienst (DWD) &

GeoSphere Austria

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Deutscher Wetterdienst
Wetter und Klima aus einer Hand

GeoSphere Austria

SLMet Sierra Leone Meteorological Agency
SIERRA LEONE METEOROLOGICAL AGENCY

WFP World Food Programme

WORLD METEOROLOGICAL ORGANIZATION

SOFF Systematic Observations Financing Facility

Alliance for Hydromet Development

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The findings, interpretations, and conclusions expressed are those of the named authors alone and do not necessarily reflect those of the agencies involved.

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Disclaimer

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List of Abbreviations

ACCA	Association of Chartered Certified Accountants
ACMAD	African Centre of Meteorological Application for Development
AGRHYMET	Regional Centre for Agrometeorology and Operational Hydrology
AgroMet	Agrometeorological
AIFS	African Integrated Forecasting System
AoE	Assessment of Environment
AVDP	Agricultural Value Chain Development Project
AWS	Automated (synoptic) Weather Station
BECE	Basis Education Certificate Examination
B.Sc.	Bachelor of Science
CAP	Common Alerting Protocol
CHD	Country Hydromet Diagnostics
CRW	Crisis Response Window
CSO	Civil Society Organisation
DBMS	Data Base Management System
ECMWF	European Centre for Medium-Range Weather Forecasts
ECMWF-IFS	European Centre for Medium-Range Weather Forecasts – Integrated Forecasting System
EPA	Environmental Protection Agency
EPS	Ensemble Prediction System
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FSRP	The Food System Resilience Program
GAFSP	Global Agriculture and Food Security Program
GFS	Global Forecast System
GBON	Global Basic Observation Network
GFCS	Global Framework for Climate Services
GTS	Global Telecommunication System
GWL	Global Warming Level
IPCC	Intergovernmental Panel on Climate Change
ICON	Icosahedral Nonhydrostatic

ICT	Information and Communication Technology
LAM	Limited Area Model
LDCs	Least Developed Countries
LEG	Least Developed Countries Expert Group
MMCET	Milton Margai College of Education and technology
MHEWS	Multi-Hazard Early Warning System
MoU	Memorandum of Understanding
M.Sc.	Master of Science
NAPs	National Adaptation Plans
NDCs	Nationally Determined Contributions
NDMA	National Disaster Management Agency
NFCS	National Framework for Climate Services
NMS	National Meteorological Services
NWP	Numerical Weather Prediction
NWRMA	National Water Resource Management Agency
ODK	Open Data Kit
OSCAR	Observing Systems Capability Analysis and Review Tool
RCC	Regional Climate Centre
RUSLP	The Resilient Urban Sierra Leone Project
RWC	Regional WIGOS Centres
SCUK	The Save the Children Fund
SLCAA	Sierra Leone Civil Aviation Authority
SLCRP	The Sierra Leone Coastal Resilience Project
SLMet	Sierra Leone Meteorological Agency
SOFF	Systematic Observations Financing Facility
SOP	Standard Operating Practices
SWFP	Severe Weather Forecasting Programme
TCP/IP T	ransmission Control Protocol/ Internet Protocol
UNDP	United Nations Development Programme
UNFCCC	United Nations Convention on Climate Change
USD	United States Dollar

WASSCE	West African Senior School Certificate
WB	World Bank
WDQMS	WMO Data Quality Monitoring System
WIGOS	WMO Integrated Global Observing System
WIS 2.0	WMO Information System 2.0
WMO	World Meteorological Organization
WMO-RO	World Meteorological Organization Regional Office

Executive Summary

The Sierra Leone Meteorological Agency (SLMet) is the National Meteorological Service of Sierra Leone and operates under the Ministry of Environment and Climate Change through a parliamentary mandate. The country experiences a tropical climate with distinct wet and dry seasons, classified predominantly as tropical monsoon (Am) along the coast and tropical savanna (Aw) inland. Sierra Leone's priority hazards include droughts, flash floods, landslides, dust, and strong winds.

Under the framework of the Systematic Observations Financing Facility (SOFF), this report has been developed in accordance with the CHD methodology to provide a high-level strategic assessment of the National Meteorological Service (NMS) and to evaluate the full meteorological value chain in the country. The assessment draws on findings from two in-country missions conducted by peer review agencies—GeoSphere Austria and Deutscher Wetterdienst—as well as a series of virtual consultations with SLMet.

Overall, the assessment indicates an average maturity score of 2 out of 5 across ten critical elements representing the meteorological value chain (see Figure 1 and Table 1).

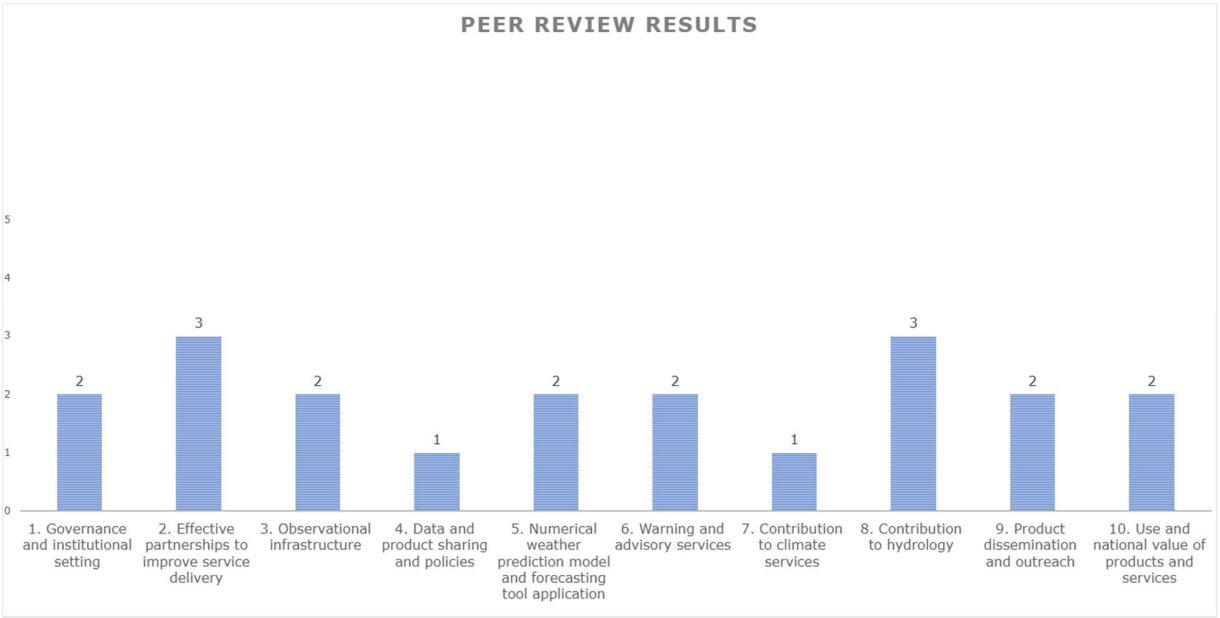

Figure 1: Overview of assessed CHD maturity level scores for SLMet

Table 1: Peer Review Results of the Ten (10) CHD Elements

Element	Maturity level score
1. Governance and institutional setting	2
2. Effective partnerships to improve service delivery	3
3. Observational infrastructure	2
4. Data and product sharing and policies	1
5. Numerical weather prediction model and forecasting tool application	2
6. Warning and advisory services	2
7. Contribution to climate services	1
8. Contribution to hydrology	3
9. Product dissemination and outreach	2
10. Use and national value of products and services	2

The **key constraints identified**, together with **the most urgent needs** and corresponding **recommendations**, are summarized in the following:

Governmental and institutional strengthening:

Although the SLMet operates under a solid legal and regulatory mandate, its ability to fulfil its mandate is constrained by some key factors:

Limited financial resources and reliance on ministerial funding, which is often delayed, hinder long-term planning and the ability to secure essential investments. These include recurring operational costs such as internet connectivity for secured data transmission, data backup systems, and staff capacity development. The absence of a cost recovery mechanism further increases dependence on fluctuating government budgets.

Human resource constraints also pose a significant challenge. Limited training opportunities and low wages contribute to a shortage of qualified staff, low retention, and high turnover.

Addressing these issues will require improved financial planning and more stable budget allocations, alongside efforts to strengthen SLMet's visibility and perceived value within government and the public. Introducing a cost recovery mechanism could provide a more reliable supplementary income stream. Nevertheless, a sufficient and stable funding from the government should be considered as a high priority to secure the core operational activities of SLMet.

Capacity-building initiatives are essential to enhance technical expertise and expand services. In this context, SLMet is pursuing closer collaboration with universities through MoUs. Plans include establishing a Department of Meteorology at the Milton Margai College of Education and Technology (MMCET) and introducing short courses for both SLMet staff and professionals in climate-sensitive sectors such as agriculture, energy, transport, water, and health.

Observation network and data management:

At present, **continuous synoptic observations in Sierra Leone are highly constrained**, with only two automated weather stations (AWS) at Lungi International Airport providing 24/7 coverage. One station is affected by recurrent wind sensor failures, reducing data reliability.

Field visits indicate that **maintenance practices** are not systematically implemented to ensure long-term operability of the observing network and consistent data quality control.

Data management also shows significant gaps. Quality control is currently conducted manually, limiting efficiency and consistency. The current backup system relies on manual mirroring to a secondary server at the same location, posing risks to data security and continuity. These issues highlight the need for improved automation and physical separation of backup infrastructure.

The establishment of a Climate Data Management System (CDMS) would significantly improve data processing, quality control, archiving, and accessibility.

As an immediate measure, replacement of the faulty wind sensors is recommended. Over the medium term, strengthening maintenance capacity through targeted training and standard operating procedures (SOPs), alongside improvements in data management, quality control, and backup systems, will be essential to ensure the sustainability and reliability of the observation network.

Numerical weather prediction model and forecasting tool application

The current use of both model and satellite imagery products is quite limited to the available products through the respective websites of the different operators of these models/EUMETSAT. Hence, it is highly recommended to strengthen the capabilities of the existing CLIMWEB platform so that both global and regional model outputs can be visualised more effectively. All relevant SLMet staff—e.g., forecasters, and climatologists —should be granted full access to this software. Expanding the internet-bandwidth provision will enable automatic reception of GRIB files from the various models. The system should also be used to present different observations such as remote-sensing and in-situ.

In a summary, in the short term, the first two stages should be:

a) through SOFF and other initiatives, ensure that existing and future surface stations are capable of providing real-time data to SLMet; and

b) establish a programme of continuous training for the relevant personnel to improve the use of the already existing model products.

In the long term, allocating staff to create basic post-processing products.

Given the limited human resources of SLMet, it is not recommended to invest in the operation and running of local models at this stage.

Warning and advisory services

Urgent action is needed to strengthen SLMet's warning and advisory services. Current capacities are very limited, with lead times of only 1–3 hours and warning coverage restricted to floods in the Freetown area, leaving much of the population unprotected. Dissemination still relies largely on informal channels such as WhatsApp and social media, limiting reach where mobile and internet access is weak.

To address these issues, existing measures such as CAP alerts should be expanded and institutionalized. Continuous engagement and sustained capacity building are essential to avoid setbacks. Regular updates, including during periods without significant events, can help establish these platforms as reliable and authoritative sources of information. Community-based approaches should be continued, as they have the highest adoption potential in remote communities.

Additionally, it is highly recommended that Sierra Leone qualify for the **Early Warnings for All** initiative, which could provide further support in establishing an effective multi-hazard early warning system**.**

Contribution to climate services

Climate services remain underdeveloped and require targeted strengthening. Historical weather and climate records are still incomplete, and digitization is ongoing. Current services are mostly basic and not yet sufficiently user-oriented. Priority should therefore be given to closer stakeholder engagement and the co-development of tailored climate products. In particular, **collaboration with the Ministry of Agriculture, Forestry and Food Security** on cropping and planting calendars could significantly improve relevance and uptake. This approach is consistent with Step 2 of the National Framework for Climate Services, which focuses on assessing user needs and jointly developing fit-for-purpose climate services.

Contribution to hydrology

Hydrological cooperation remains insufficiently formalized and should be strengthened as a priority. Although SLMet and NWRMA cooperate ad hoc, systematic coordination is still constrained by the absence of formal SOPs, data-sharing agreements, and integrated operational arrangements. Hydrological monitoring is also weak, with limited functioning surface water stations and no operational groundwater stations. In addition, the lack of cross-border data exchange, particularly in the Mano River Basin, limits timely flood forecasting and response. Priority actions should focus on **formalizing institutional cooperation, rehabilitating hydrological stations, improving data integration, and strengthening regional information exchange** to enhance flood early warning and water resources management.

Product dissemination and outreach & use and national value of products and services

Sierra Leone continues to face major challenges in product dissemination and outreach to all population groups with timely warnings and advisory services, particularly in remote and last-mile communities. Access barriers remain significant, including **limited internet connectivity, low smartphone availability, and language and literacy constraints**. The establishment of the ClimWeb platform is a positive step, but further efforts are needed

to make warning communication more inclusive, accessible, and effective. User engagement and service development are still at an early stage. Services remain largely limited to basic weather information and aviation-related products, while systematic user engagement, co-design, and multi-sectoral coordination are still lacking. Feedback mechanisms remain ad hoc, and quality management has so far only been developed for aviation.

Next steps should include institutionalising **user feedback, expanding engagement platforms** to a multi-hazard and nationwide level, completing the **aviation QMS**, and progressively extending **quality management** across all service areas.

CHAPTER 1: GENERAL INFORMATION

Introduction

Sierra Leone, located on the west coast of Africa, has a population of approximately 9 million people (2024) and covers an area of about 71,740 km². The country features a varied landscape that includes a coastal belt of mangrove swamps, wooded hill country, an upland plateau, and mountain ranges in the eastern region. Sierra Leone experiences a tropical climate with distinct wet and dry seasons, classified mainly as tropical monsoon (Am) along the coast and tropical savanna (Aw) inland. These climate variations are influenced by elevation and proximity to the Atlantic Ocean (see Figure 1) (https://www.cia.gov/the-world-factbook/countries/sierra-leone/#introduction).

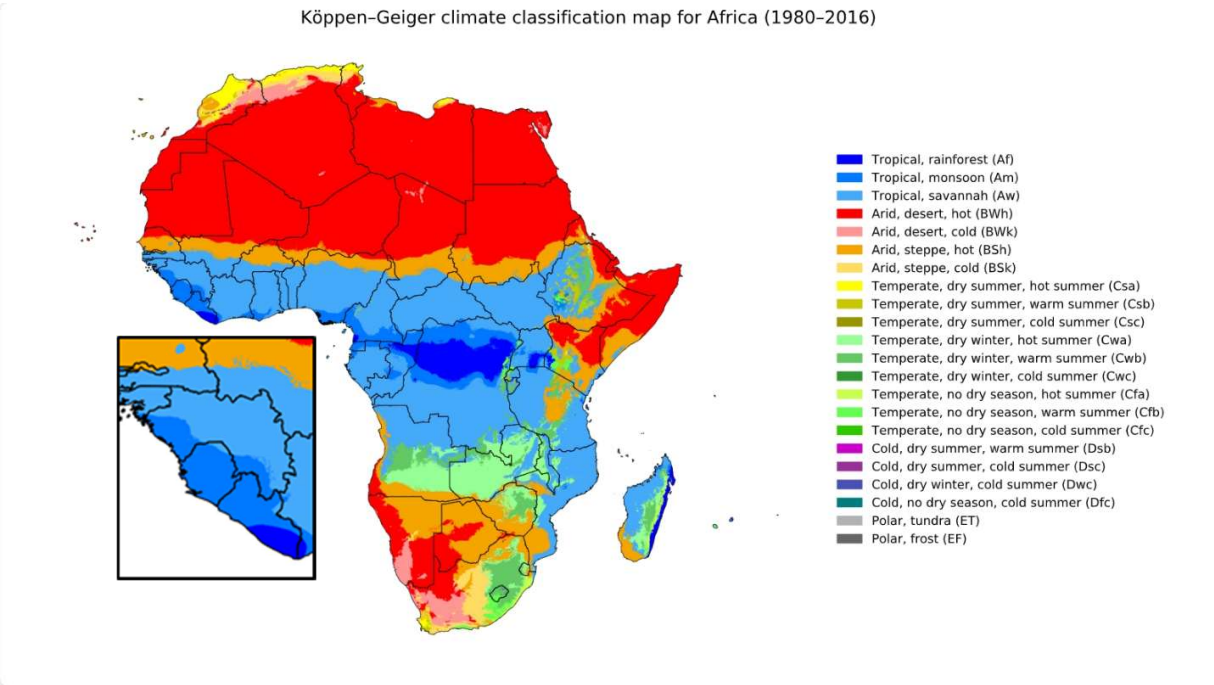

Figure 2: Beck et al.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018)

According to the World Bank Climate Change Knowledge Portal, Sierra Leone's mean annual surface air temperature for the period 1991–2020 averaged 26.54 °C, with seasonal monthly means ranging between 25.2 °C and 28.5 °C. Temperatures in West Africa generally have risen 1°C–3°C since the mid-1970s.

According to the IPCC, Sierra Leone' average annual temperatures are projected to rise to 27 °C under SSP1-1.9[1] and up to 30 °C under SSP5-8.5 by the end of the century, with extreme heat days (heat index >35 °C) increasing from 44–85 per year by mid-century to 38–288 per year by century's end, especially in the northern and eastern provinces (WB

[1] SSP1-1.9 represents the "sustainability pathway," a best-case situation in which Paris Agreement targets are met by 2050 and global warming is kept to around 1.5°C by 2100. SSP5-8.5 is the "fossil-fueled development pathway," in which emissions levels roughly double by 2050 and warming reaches 4.4°C or higher (WB 2025).

2025), placing extreme pressure on the population and economic sectors. Future projections of changes in precipitation and the number of wet days in Sierra Leone remain uncertain due to gaps in long-term, high-quality rainfall observations and the complex dynamics of the West African Monsoon system. Nevertheless, rising temperatures are known to increase the likelihood of more erratic rainfall patterns and more intense precipitation events, thereby elevating the risk of flooding, landslides, and land degradation, particularly in low-lying and coastal areas.

Sierra Leone already ranks among the countries with very high rainfall totals, with an average annual precipitation of approximately 2,653.4 mm. Between 1991 and 2020, average monthly precipitation ranged from 6.8 mm in the driest month to 612.7 mm in the wettest month (WB, 2025).

Even, under the most optimistic scenario (RCP 2.5), Sierra Leone may experience slightly increased total rainfall, accompanied by greater precipitation variability and more intense rainfall extremes. These changes are projected to heighten climate-related risks, particularly flooding and landslides, with significant implications for vulnerable populations and key economic sectors. This is consistent with the country's recent experience of frequent climate-related disasters, including recurrent floods, landslides, droughts, and wildfires over the past decades.

Under the most pessimistic scenario, by contrast, Sierra Leone may experience declining total rainfall and fewer wet days, increasing the risk of droughts, water scarcity, and wildfires (WB2025).

Inform Risk Index

The country has an Inform risk index of 5.1 (scale 0-10, 0 is optimum) and is thus positioned in the risk class "Medium", meaning that the country, considering the Inform criteria, is at a medium risk of a humanitarian crisis in case of natural or man-made disaster. The coping capacity of the country is relatively low. Hence, it is clear as already past disasters demonstrate, that disasters with major impacts occur and the country requires additional major effort to be prepared for them. For more information, visit https://drmkc.jrc.ec.europa.eu/inform-index/INFORM-Risk/Results-and-data.

Hazard and exposure: 3.8 [0-10]

Vulnerability: 5.1 [0-10]

Lack of coping capacity: 7.0 [0-10]

The Sierra Leone Meteorological Agency in a nutshell

The Sierra Leone Meteorological Agency (SLMet) was established in 2017, under the parliamentary act no.8, replacing the Sierra Leone Meteorological Department, founded immediately after independence in 1960. The Department, as the entire country, suffered from the overall devastation caused by the civil war in 1991-2002 and began slowly its recovery with the end of the war.

SLMet currently operates as Sierra Leone's national meteorological agency under the Ministry of Environment and Climate Change. It brings together a diverse range of expertise to meet the country's weather and climate needs. Its team of experts delivers comprehensive services across seven key areas: aviation meteorology for safe flights, hydrometeorology for water resource management, climate services including seasonal forecasts, marine weather for coastal and offshore activities, environmental monitoring for air quality and sustainability, agro-meteorology to support farming communities, and daily weather forecasts for the general public.

CHD methodology

The present report has been prepared in accordance with the methodology outlined in the 2022 update of the Country Hydromet Diagnostics (CHD). The CHD process involved two in-country missions conducted in May 2025 and March 2026. Both missions included a series of stakeholder consultations (see Annex 1), as well as visits to the SLMet Headquarters the National Forecasting Centre, as well as the Lungi International Airport. In addition, a range of observational stations—synoptic, rainfall, and marine stations—were visited in Freetown, Makeni, and Bo.

This report is intended to provide crucial information for the SOFF initiative implementation phase, which in Sierra Leone is coordinated by GeoSphere Austria together with the Deutscher Wetterdienst (DWD) and with the World Food Programme (WFP) as Implementing Entity, as well as informing the ambitious Early Warnings for All (EW4All) initiative of the United Nations (UN). The assessment by GeoSphere Austria and the Deutscher Wetterdienst has been facilitated by two on-site visits as well as several remote consultations. Following the CHD structure, this report is presented along the ten most critical elements of the hydromet value cycles with an indication of their respective maturity level and some high-level recommendations to help lift up that maturity level, and as mentioned above, with special emphasis on monitoring, forecasting, climate projection and warning systems for climate-related hazards, across timescales.

The CHD provides a high-level strategic assessment of National Meteorological and Hydrological Services (NMHS), their operating environment, and their contribution to high-quality weather, climate, hydrological and environmental services and warnings. It integrates existing approaches, standards and data provided by WMO and partners, using a peer review approach. The CHD methodology (2022 update of the CHD) has been developed under WMO leadership and with guidance of a multi-party Working Group. The CHD 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.

This report is one of the results of a much wider-scope project, coordinated by the Systematic Observations Financing Facility (SOFF) Secretariat under the World Meteorological Organization (WMO). SOFF aims at creating a sustainable process to enhance and strengthen the National Surface and Upper-Air observational networks and to bring them closer to the Global Basic Observations Network (GBON) criteria. In addition, the SOFF initiative is now a part of a much larger initiative, namely the EW4All, targeted at providing early warning

information of weather and climate induced disasters to everybody on Earth by 2027. Following the defined methodology, the CHD is based on the ten most critical elements of the hydro-met value cycle, grouped under four categories – (i) enablers, (ii) observation and data processing system, (iii) service and product production and dissemination, and (iv) user and stakeholder interaction.

The 10 elements of the Diagnostic are defined as follows:

Enablers

(1). Governance and institutional setting - The formalization of the NMHS mandate and its implementation, oversight, and resourcing.

(2). Effective partnership to improve service delivery - Effectiveness of the NMHS in bringing together national and international partners therefore improving the service offering. This includes the academic, research, private sector and climate and development finance institutions.

Observation and data processing system

(3). Observational infrastructure - The level of compliance of the observational infrastructure and its data quality with prescribed standards.

(4). Data and product management, sharing, and policies - The nature of data and product sharing on a national, regional, and global level.

(5). Numerical model and forecasting tool application - The role of numerical model output and forecasting aids such as remotely sensed products in product generation; whether models are run internally and if the value-added compared to global models is determined.

Service and product production and dissemination

(6). Warning and advisory services - NMS role as the authoritative voice for weather related warnings and its operational relationship with disaster and water management structures.

(7). Contribution to climate services - NMS role in and /or contribution to a national climate framework according to the established climate services provision capacity. The assessment on this point will be based on, and complement the recently completed work on, the capacity assessment of climate information services in North Macedonia.

(8). Contribution to hydrology - NMS role in and contribution hydrological services according to mandate and country requirements.

(9). Product dissemination and outreach - Effectiveness of the NMS in reaching all public and private sector users and stakeholders.

User and stakeholder interaction

(10). Use and national value of products and services - Accommodation of public and private sector users and stakeholders in the service offering and its continuous improvement.

For each value cycle element, a limited number of standardized indicators is 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. Note that Level 5 is the highest attainable maturity level in the CHD assessment.

CHAPTER 2: COUNTRY HYDROMET DIAGNOSTICS

Element 1: Governance and institutional setting

1.1 Existence of Act or Policy describing the NMHS legal mandate and its scope

Sierra Leone has established a clear legal framework defining the mandate and operational scope of its National Meteorological Service (NMS) through the enactment of the Sierra Leone Meteorological Agency Act, 2017 (Act No. 8 of 2017) and its subsequent amendment in 2022. This Act formally transformed the Meteorological Department, previously under the remit of the Ministry of Transport and Aviation, into SLMet, defining its functions, management structure, and institutional responsibilities. Hydrology in turn falls under the *National Water Resources Management Agency Act, 2017* (Act No. 5 of 2017).

The Act grants the SLMet sole authority to provide meteorological and climatological services throughout Sierra Leone, including in the aviation, agriculture, and marine sectors. SLMet provides relevant meteorological information and services for aviation at the Freetown International Airport, Lungi.

Furthermore, SLMet serves as the single designated national warning authority for hydrometeorological hazards, responsible for issuing official forecasts and alerts, while the National Disaster Management Agency (NDMA), under the NDMA Act of 2020, is tasked with communicating these warnings to the public and coordinating response efforts. The 2022 amendment further expanded the Agency's governance to encompass a broader spectrum of sectoral stakeholders and formally established six specialist departments. This reflects the increasing importance of climate services in national planning and resilience efforts. However, despite there being an official hydro-meteorology department, it is not yet fully operational. Additionally, the amendment clarified ministerial oversight by placing the Agency under the Ministry of the Environment and Climate Change. Together, these legal instruments provide a comprehensive mandate for Sierra Leone's NMS, strengthening its institutional capacity and legal authority to support national development, environmental monitoring, and disaster preparedness. The Act provides for SLMet to establish a cost-recovery mechanism for its diverse services in order to enhance sustainability. Such a mechanism could further strengthen this position by generating additional revenue, thereby increasing the agency's operational flexibility and more effectively demonstrating its value to the public.

1.2 Existence of Strategic, Operational and Risk Management plans and their reporting as part of oversight and management.

Currently, there is no operational, risk, or strategic plan in place. The last actual strategic plan ended in 2023.

However, SLMet is currently receiving support from the WMO with establishing a Quality Management System (QMS). Policies are being developed and dedicated staff are being appointed, with the aim of achieving full QMS implementation and successful certification in 2026. Although the QMS is primarily being implemented to support meteorological services for aviation, it also covers a wide range of general operational duties of the NMS.

A National Framework for Climate Services (NFCS) was developed in 2020 in collaboration with WMO under the Global Framework for Climate Services (GFCS), together with a corresponding implementation plan for the period 2020–2025. Due to limited resources, the activities identified in the NFCS have so far only been implemented in a fragmented manner through a limited number of projects and programs carried out in the country. However, SLMet remains committed to continuing the implementation of the identified activities in the coming year and to updating and extending the implementation plan accordingly.

For the next years, SLMets main priority areas are the delivery of enhanced weather and climate services.

1.3 Government budget allocation consistently covers the needs of the NMHS in terms of its national, regional, and global responsibilities and based, among others, on cost-benefit analysis of the service. Evidence of sufficient staffing to cover core functions

The primary financial support provided to SLMet is through governmental funding, which however only covers recurrent activities including basic operational expenses, and does not cover capital investments. The operational budget does not include salaries, as they are paid directly by the Ministry of Finance. The government's budget allocations showed an upward trend from USD 65,918.6 in 2021 to USD 188,778.4 in 2024. A decline in funds received in 2025 is evident, with a decrease amounting to USD 175,314.4 and even further decrease in 2026 down to 67,510.0 USD (see Figure 3). In addition, budget disbursement from the Ministry of Finance to SLMet are often subject to significant delays. Together with the limited budget, this presents an additional operational challenge. Consequently, SLMet will need to incorporate these delays into its financial planning to maintain operations despite budgetary constraints. This may include prepaying yearly internet subscriptions for a defined number of the most critical automatic weather stations to ensure uninterrupted data transmission.

In selected cases, supplementary financial resources are allocated through the acquisition of emerging projects.

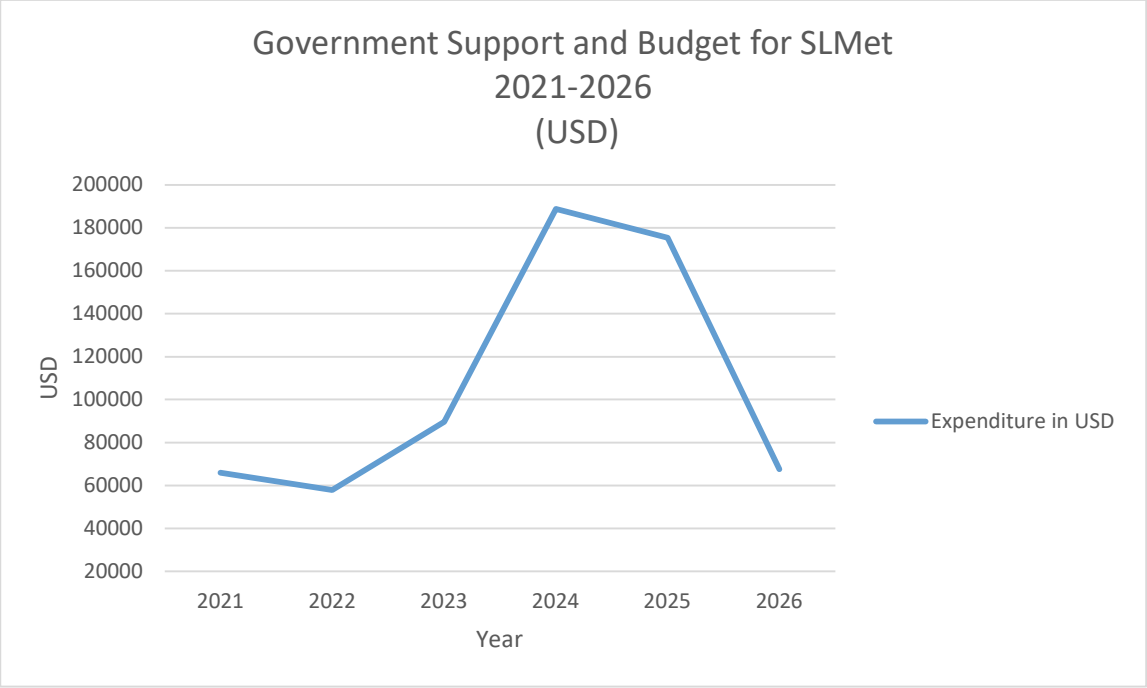

Figure 3: Budget trends SLMet (2021-2026) in USD

The distribution of expenditures is allocated to the various fields of activity of the SLMet. Most of the budget, constituting 30% of the total, is allocated to "Administrative costs and enhanced logistical support for service delivery." The following three key activities are each allocated 20% of the total budget: "Improved quality of weather and climate information, products and early warning", "Improved access to weather and climate information, product and early warning", and "Improved relevance of weather and climate information product and early warning." The residual 10% is allocated for the purpose of "Enhanced partnership in improving weather and climate products and early warning systems."

Although there is currently no cost recovery mechanism in place, particularly regarding aviation, this has already been included in the Act. However, the necessary regulations to bring it into force are still lacking. SLMet is currently consulting with stakeholders in preparation for a draft Cabinet paper.

Even though negotiations are currently underway regarding cost recovery from the aviation sector for SLMet, it is important to put expectations into perspective. Due to the relatively low number of flights currently handled at Lungi International Airport, the additional revenue generated will not fully resolve SLMet's existing budgetary challenges. Nevertheless, any additional income remains valuable and contributes positively to supporting Sierra Leone's meteorological services.

1.4 Proportion of staff (availability of in-house, seconded, contracted- out) with adequate training in relevant disciplines, including scientific, technical, and information and communication technologies (ICT). Institutional and policy arrangements in-country to support training needs of NHMS.

SLMet currently employs 64 people, 25% of whom are women. The majority of staff are aged between 35 and 44 (Figure 4). Technical staff account for 77% of employees, while administrative staff account for the remaining 23%. The following table shows the share of the highest educational degrees of all employees. Higher educational qualifications are predominantly held by male employees.

Table 2: Overview of highest educational level of SLMet staff

Highest Degree	Male	Female	Sum	%
M. Sc., MBA and MA.	3	1	4	6.35
B.Sc. or equivalent	18	3	21	33.33
Diploma	3	1	4	6.35
West Africa Senior Secondary School Examination Certificate (WASSCE)	17	11	28	44.44
Basic Education Certificate Examination (BECE)	3	0	3	4.76
Driving certificate	4	0	4	6.35

Master's and Bachelor's degrees are obtained in relevant disciplines, e.g. Meteorology and Climate, Sustainable Development, Environment, Physics, Mathematics, Geography, Geology, Civil Engineering, Information Technology, and Financial Services, Finance, and Business Administration for administrative staff.

The following table illustrates the distribution of employees by area of responsibility.

Designation	Male	Female	Sum	%
DIRECTOR GENERAL	1	0	1	2
DEPUTY DIRECTOR GENERAL (Head of Operations)	1	0	1	2
DEPUTY DIRECTOR GENERAL (Admin)	1	0	1	2
METEOROLOGICAL OBSERVER	17	13	30	48
TRAINEE METEOROLOGIST	9	0	9	14
DRIVER	4	0	4	6
OFFICE ASSISTANT	3	1	4	6
FORECASTER	2	1	3	5
IT OFFICER	2	0	2	3
ADMINISTRATIVE ASSISTANT	0	1	1	2
ADMINISTRATIVE OFFICER	1	0	1	2
ASSISTANT ADMIN OFFICER	1	0	1	2
CLIMATE CHANGE OFFICER	1	0	1	2
INSTRUMENT TECHNICIAN	1	0	1	2
INTERNAL AUDITOR	1	0	1	2

PROCUREMENT OFFICER	1	0	1	2
PUBLIC RELATION OFFICER	1	0	1	2
STORE CLERK	0	1	1	2

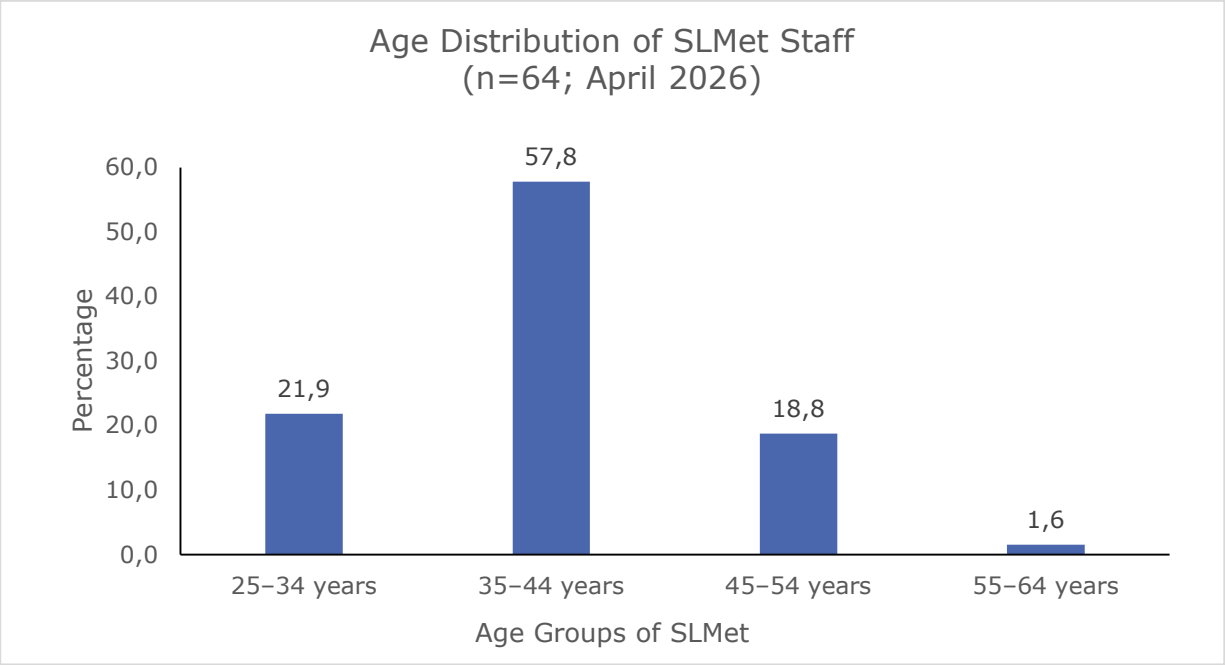

Figure 4: Age distribution SLMet staff (2026)

SLMet is clearly experiencing a significant shortage of personnel across multiple functional areas. Several critical roles, including meteorological specialists, are currently staffed by only one individual, creating vulnerability to service disruptions and limiting opportunities for sustainable knowledge transfer. Key fields such as agrometeorology, marine meteorology, IT, and climate-related services remain underrepresented. In addition, essential positions—including hydrometeorologists and hydrometric technicians—are vacant, leaving the hydrometeorological department non-operational due to the lack of trained personnel.

According to SLMet's assessment, a workforce of approximately 250–300 staff is required to adequately fulfil its mandate as the National Hydrometeorological Service, including weather forecasting, climate monitoring, early warning systems, and sector-specific services. This estimate aligns with the Government of Sierra Leone's institutional framework, which emphasizes nationwide coverage and decentralized service delivery across diverse climatic zones. Given the country's diverse climatic zones and vulnerability to extreme weather events, sufficient personnel are required to ensure effective monitoring and service provision across all districts and chiefdoms. This includes specialized expertise and skilled personnel in key operational areas such as agrometeorology, hydrometeorology, marine meteorology, climate change, as well as public communication and administrative support. Considering the ongoing automation of weather stations, this figure may be somewhat overestimated, as there will likely be fewer manual stations in the future and therefore a reduced need for observers.

However, a workforce of around 200 employees could still represent a reasonable and forward-looking vision for Sierra Leone's meteorological service.

1.5 Experience and track record in implementing internationally funded hydromet projects as well as research and development projects in general.

The Deputy Director General (Head of Operations) of SLMet is the designated United Nations Convention on Climate Change (UNFCCC) Focal Point for Sierra Leone. The nature of this role entails the coordination of the Mitigation and Science negotiations for the 46 Least Developed Countries (LDCs) under the UNFCCC, in addition to the provision of expert input on international climate policy. Furthermore, he has been a member of the UNFCCC Least Developed Countries Expert Group (LEG) and has served as its Chair for two consecutive terms.

During the visit in May 2025, efforts were initiated to establish a Department of Meteorology at the MMCET which would also cover the fields of climate change, environmental sciences, hydrology, and radiation physics. As of March 2026, the curriculum is under development, and discussions are ongoing regarding possible support from the University of Vienna in the development of the curriculum.

With the University of Sierra Leone, joint research projects are intended to be developed, and Memoranda of Understanding (MoU) are to be established with the Fourah Bay College as well as the MMCET in order to offer short courses and develop new modules.

Further information on experiences in the implementation of internationally funded projects will be given in Chapter 2.

Summary score and recommendations for Element 1

In summary, SLMet operates under a solid legal and regulatory mandate with clearly defined objectives. However, it currently lacks clearly articulated strategic priorities for the coming years, and its operational services for issuing warnings are limited to riverine floods. Many ambitious goals, such as climate projections, satellite data processing, and marine and hydrological services, cannot yet be adequately met due to key challenges: no cost-recovery regulation, a shortage of professional staff, and high turnover due to insufficient salaries, all of which limit the agency's capacity to fulfill its mandate.

Therefore, for Element 1, the Maturity Level has been defined as 2.

A primary challenge under Element 1 remains the significant shortage of financial and human resources, which has severely constrained strategic planning and the effective implementation of SLMet's mandate. It is estimated that the SLMet would require a minimum of 200 staff to fully fulfil its mandate and adequately cover operations at the regional level.

To address these challenges, SLMet is currently in the process of establishing regulatory frameworks that will facilitate the establishment of cost recovery mechanisms. These mechanisms will enable the agency to bill for the delivery of its services. The regulation itself is already part of the Sierra Leone Meteorological Agency Act, but it still lacks clearly defined regulations to become operational. The initial steps towards drafting a cabinet paper have already been initiated. In addition, the development of a new strategic plan is highly recommended, with a focus on the provision of further services to meet the needs of additional stakeholders. This would serve to emphasize the significance of the SLMet.

The shortage of qualified personnel can be attributed to two fundamental problems. On the one hand, there is a limited availability of training opportunities for meteorological specialists in Sierra Leone, meaning that training must be obtained from outside the country. Secondly, low wages result in low staff retention and high turnover. To address these issues, discussions have been initiated on strengthening collaboration with universities in Sierra Leone through MoUs. In particular, the establishment of a Department of Meteorology at MMCET is currently under consideration. In addition, there are plans to introduce short courses at various universities. These would serve both as refresher training for weather service employees and as introductory courses for professionals in sectors such as energy, agriculture, transportation, water management, and health, whose activities intersect with meteorological information.

Another proposed measure is the installation of manual weather stations on university campuses. These stations could function as practical training facilities for students while also sparking broader interest in meteorology. They could additionally serve as educational sites for school field trips, helping younger generations understand weather observation, data collection, and interpretation.

Further opportunities for training and capacity development are available through the WMO Fellowships Programme.

SLMet's vision for the future emphasizes its goal to become a certified WMO regional training center, offering both on-site and remote courses, while providing more competitive salaries to attract and retain skilled staff.

Element 2: Effective partnerships to improve service delivery

2.1. Effective partnerships for service delivery in place with other government institutions.

During the course of the visits, it was noted that several partnerships had been established—but not yet formalized—between SLMet and government institutions, including the Environmental Protection Agency (EPA), the National Disaster Management Agency (NDMA), the National Water Resource Management Agency (NWRMA), the Sierra Leone Civil Aviation Authority (SLCAA), the Ministry of Environment and Climate Change, the Ministry of Agriculture and Food Security, and the Ministry of Transport and Aviation.

While NDMA and SLMet engage in continuous, close collaboration daily at operational, strategic, and technical levels, working relations with the Ministries of Energy and the Agriculture and Food Security could be more proactive. The Ministry of Agriculture and Food Security relies heavily on meteorological data from SLMet regarding forecasts and seasonal outlooks. However, more tailored product services, such as planting calendars, are expected to play an even greater role in the future. The area of weather insurance for agriculture presents additional opportunities, especially for large agricultural enterprises, where reliable weather data is crucial.

Furthermore, several ideas were discussed during the meetings held as part of the visits, highlighting the need for closer collaboration and more regular exchanges. Topics covered included training for extension officers on how to interpret weather information for farmers

and improving systems to effectively deliver information to farmers (e.g. video/ audio messages for meteorological information).

2.2. Effective partnerships in place at the national and international level with the private sector, research centres and academia, including joint research and innovation projects.

SLMet is frequently approached by construction companies, the mining sector, and the Assessment of Environment (AoE) for its climate and weather data. Currently, this information is provided free of charge.
With the establishment of a cost-recovery framework, legal provisions can be developed to set up fees for services provided to the private sector, creating a potential revenue-generating opportunity for SLMet.

SLMet has recently begun collaborating with the University of Sierra Leone on a joint research proposal on climate and health, as noted in Chapter 1. However, this initiative is still at the proposal stage. Furthermore, SLMet is currently finalizing Memoranda of Understanding (MoUs) with the University of Sierra Leone, Milton Margai Technical University, and Ernest Bai Koroma University to strengthen collaboration in research exchange, curriculum development, and the broader educational system.

In addition, a South–South collaboration in the form of a Memorandum of Understanding (MoU) is currently being developed with the Tanzania Meteorological Authority (TMA) as well as with ACMAD and AGRHYMET.

The recently established Flood Task Team—comprising SLMet, NDMA, and NWRMA—functions as a multi-sector platform to address one of the country's priority hazards.

2.3. Effective partnerships in place with international climate and development finance partners.

SLMet is engaged in several projects funded by international climate and development finance partners, which are described below:

The Food System Resilience Program (FSRP) is a five-year regional initiative implemented across seven African countries, including Sierra Leone. In Sierra Leone, the program totals USD 135 million, financed through three sources: the original FSRP (World Bank) – USD 60 million, the Crisis Response Window (CRW) – USD 50 million, and the Global Agriculture and Food Security Program (GAFSP) – USD 25 million.

The additional GAFSP grant will expand the program's reach to 943,200 beneficiaries, focusing on vulnerable households in six districts across the country, which were selected based on food insecurity, production potential, market access, and regional balance.

The program will bring an additional 24.500 hectares under cultivation, including 9.000 hectares of rice and nutrient-rich crops such as biofortified cassava and orange-fleshed sweet potatoes, benefiting about 110,000 people. It aims to reduce food-insecure households by 25% and stabilize local food prices.

Through this initiative, SLMet just recently received 15 Agromet stations, which are currently being installed (started in April 2026), and will be supported by the program in providing

climate and weather data to guide climate-smart and resilient agricultural practices, ensuring sustainable productivity gains.

The Resilient Urban Sierra Leone Project (RUSLP) is a World Bank–funded initiative implemented by various stakeholders and government agencies. Lead technical agencies comprise the Environment Protection Agency (EPA), the Ministry of Environment and Climate Change, the Ministry of Lands, Housing and Country Planning, and the National Disaster Management Agency (NDMA). Its objective is to improve integrated urban management, service delivery, and disaster emergency management in the Western Area and selected secondary cities.

The project comprises four key components, and SLMet contributes under Component 3 by providing weather, climate, and early warning information to enhance disaster preparedness, urban resilience planning, and risk reduction. SLMet's inputs ensure that urban management and emergency response are informed by reliable, science-based climate data.

In this context, CREWS – under the RUSLP – established a Flood Forecasting Task Force, in order to maintain and operationalize the capacities developed within its participating parties (CREWS 2025). Furthermore, CREWS within its initiative *Sierra Leone: Jumpstart Early Warning and Early Action Systems (ASW)*, provided on-the-job training to staff of SLMet and NWRMA to strengthen forecasting capacities as well as weather data utilization and management, and flood warning communications.

The Sierra Leone Coastal Resilience Project (SLCRP)[2] is funded by the Green Climate Fund with a project period of 60 months. It is executed by Save the Children Sierra Leone, Environmental Protection Agency of Sierra Leone and The Save the Children Fund (SCUK). The project aims to strengthen the climate resilience of coastal communities and ecosystems while supporting the Government of Sierra Leone in advancing its national climate change priorities. The project focuses on building local capacity for climate adaptation through measures such as enhancing climate resilience in the water, sanitation, and hygiene (WASH) sector, promoting sustainable and climate-smart livelihoods for farmers and fishers, improving food value chains, and supporting sustainable natural resource management. It also emphasizes the conservation and restoration of mangroves as a key strategy for coastal protection and ecosystem resilience.

These initiatives depend on reliable weather data from SLMet to enable informed decision-making and adapted project planning and execution.

Furthermore, UN organisations such as the World Food Programme (WFP) are reliant on cooperation with SLMet to implement their projects, which necessitate meteorological data for successful execution or to anticipate humanitarian crises that are particularly exacerbated by climate change through anticipatory action, e.g. the joint development of risk maps.

A strong partnership also exists with the United Nations Development Programme (UNDP), which played a key role in supporting SLMet's rebuilding efforts after the Civil War. This support included the provision of equipment, capacity-building initiatives for SLMet staff—such as training programmes in Reading, UK—and funding for a delegation to participate in the COP.

[2] https://www.greenclimate.fund/project/SAP036#documents

SLMet's further international engagement is reflected in its efforts to join the Early Warnings for All (EW4All) initiative. A request for participation has already been submitted, and the start of its active engagement is expected during the course of 2026.

Further partnerships are in place with civil society organisations, including GOAL and Red Cross Sierra Leone, especially in the areas of Disaster Risk Management and Emergency Response. Based on data provided by SLMet risk prone areas are being identified and community-based trainings are being implemented in order to improve responsiveness. Examples to mention are early warning and rescue groups for fishermen, based on marine forecasts, and the use of colour schemes for warnings.

Through cooperation with Action Against Hunger, SLMet received five agrometeorological stations, of which two have already been installed. In addition, the CSO is currently developing a mobile application for SLMet to support the delivery of weather and warning services, as the previous application is no longer operational. The provision of weather information is particularly important for the CSO's primary target group, namely farmers.

2.4. New or enhanced products, services or dissemination techniques or new uses or applications of existing products and services that culminate from these relationships.

Through cooperation with the World Meteorological Organization Regional Office for Africa (WMO-RO), SLMet received support in the establishment and operationalization of its website (including CAP warnings), LinkedIN page and a dedicated WhatsApp channel, which are used to deliver impact-based weather information and warnings to the public. Corresponding training was conducted in early March 2026.

Summary score, recommendations, and comments for Element 2

Given the well-established relationships with government institutions mentioned above, as well as the ongoing discussions to formalise cooperation with universities, the maturity level for **Element 2** is set at **3**.

However, formalised agreements with both the public and private sectors — for example, concerning tailored services — could be a great opportunity for the SLMet to demonstrate their value while generating additional income and enabling more sustained operationalisation.

It is evident that a significant number of stakeholders could greatly benefit from the services provided by the weather service, and the successful implementation of numerous projects is contingent on the availability of reliable data. This underscores the necessity for reinforcing the capabilities of the meteorological service. Furthermore, it exemplifies the substantial potential that can be realised through the integration of robust data with effective partnerships.

Element 3: Observational infrastructure

3.1. Average horizontal resolution in km of both synoptic surface and upper-air observations, including compliance with the Global Basic Observing Network (GBON) regulations.

SLMet operates under significant limitations. Many observation stations and facilities were destroyed during the Civil War (1991-2002), leaving the country with a partially functional observing network.

Currently, only two automated synoptic stations (AWS) at Lungi International Airport provide 24/7 data coverage. Data from these two AWS are transmitted via a high-speed (HS) terminal to several international airports. However, the observations are only partially shared internationally through the Global Telecommunication System (GTS), and they are not transmitted in real time to SLMet Headquarters. The data can, however, be accessed through the Pulsonic Data Dashboard, allowing their usage for operational forecasting activities. One of the stations nevertheless experiences operational challenges during periods of strong winds, which can occasionally lead to measurement failures.

A third station at Lungi International Airport transmits data to SLMet Headquarters via manual readings and transmission and serves as a backup system for the airport in the event of failure of the primary AWS. However, the station's wind anemometer is faulty. All other parameters are recorded reliably, but the observations are neither continuous (24/7) nor consistently reported on an hourly basis.

Additional automated synoptic stations (AWS) are installed at the SLMet Forecasting Centre in Tower Hill, Freetown, as well as in Kambia, Bo, and Bonthe. However, the lack of a continuous internet subscription has so far prevented automatic and uninterrupted transmission of observational data, thereby limiting their use for real-time operational purposes.

To partially address this limitation, a WhatsApp group was established in 2021. In this group, observation readings from several synoptic and agrometeorological stations—including Kono, Kenema, Tower Hill (two stations), Kailahun, and Bonthe—are shared manually at 09:00, 12:00, and 17:00 local time with the forecaster team in Freetown. These observations allow forecasters to verify numerical model outputs and adjust the national forecast accordingly. However, automated transmission would enable hourly data transfer, improve the quality of forecasts, and significantly simplify the process.

Data from the remaining stations are mostly shared once a month or quarterly by manual readings via text messages to the HQ, where they will be ingested into an Excel spreadsheet, mainly for climate services.

Data from automated rainfall stations would be transmitted automatically to headquarters when subscriptions are active. Currently, however, they are only activated when there is an urgent need for data.

In March 2026, within the framework of a training organized by the World Meteorological Organization (WMO) Regional Office, the installation of an ADL and a WIS 2.0 node was completed. As part of this process, three stations—Lungi, Tower Hill, and Kambia—were registered for data sharing through the WIS 2.0 framework. However, a lack of internet subscription again does prevent reliable transmission.

In summary, continuous data transmission is currently ensured only for the two stations located at Lungi International Airport. For other automated stations, data transmission remains intermittent due to the absence of reliable, continuous connectivity. At present, when observational data is required, limited mobile data is temporarily loaded onto the stations' SIM cards to facilitate the retrieval of the relevant information.

Observation Network:

SLMet's current observation network comprises 83 automated stations, and 12 manual stations comprising:

* All automated stations have no secured long-term internet subscription. Therefore, stations only disseminate data when credit is activated, which is currently only happening on ad-hoc basis.

- 60 rainfall stations/ 35 functional
- 11 agrometeorological stations/ 5 functional
- 7 synoptic stations / 7 functional
- 5 marine stations / 3 operational
- 3 manual synoptic stations / 3 operational (Lungi, Makeni, Tower Hill)
- 9 manual rainfall stations / 0 operational

While these stations are distributed nationwide, synoptic coverage is limited to the Western Area Urban, Northern, Northwestern, and Southern regions. The Eastern region currently lacks synoptic observation coverage, with only rainfall and agrometeorological stations installed (see Figure 5). Currently, the country operates no radiosonde or radar stations, the latter having been destroyed.

Figure 5: Map of current synoptic observation network of SLMet (source: QGIS/ data from SLMet)

SLMet has further received AWS donations through UNDP and CREWS. Eight UNDP-procured stations installed on cell towers across the country never shared data with SLMet and are therefore not considered part of the official network. Other donated stations either produced erroneous data or failed to maintain continuous transmission.

Through the FSRP project, 15 AgroMet stations, manufactured in China, were provided to SLMet in late October 2025, and are yet to be installed.

In summary, the SLMet operates a relatively comprehensive observational network with lack of robust maintenance and calibration mechanism. However, its effective functionality is significantly limited, as only a few stations are able to transmit data reliably due to the lack of continuous internet subscriptions and the presence of non-operational stations. When it comes to hazard monitoring only the variables, precipitation and wind are currently

monitored. None of the stations currently meet the requirements of the Global Basic Observing Network (GBON). Consequently, there is presently no defined horizontal resolution for synoptic surface and upper-air observations across the country.

3.2. Additional observations used for nowcasting and specialized purposes.

SLMet receives hydrological data from the NWRMA upon request; however, this is limited to a small number of surface water stations, as currently only 12 out of 28 are operational. Furthermore, NWRMA operates 32 groundwater stations, of which 15 are currently operational (March 2026). Satellite imagery is used and accessed via the EUMETView web portal and Windy.

3.3. Standard Operating Practices in place for the deployment, maintenance, calibration, and quality assurance of the observational network.

SLMet currently operates without established Standard Operating Procedures (SOPs) for the deployment, maintenance, calibration, and quality assurance of its observational network. This is largely due to limited technical capacity to conduct regular calibration activities and implement systematic quality control mechanisms. Although a quarterly maintenance cycle is formally prescribed, only two staff members are currently trained to perform basic maintenance procedures, which significantly limits the ability to maintain the network consistently.

This constraint was reflected during station visits conducted in March 2026, where maintenance conditions were found to vary between stations. At most sites, general upkeep was insufficient, with stations not properly cleaned and surrounding vegetation inadequately controlled.

Establishing and implementing clear SOPs for station maintenance is therefore essential to ensure the reliability and sustainability of the observational network. Given that many stations are installed on the premises of government institutions, schools, or universities, it would also be beneficial to introduce awareness and basic training activities for host institutions. Involving these institutions—potentially even through educational activities or curricula—could help ensure that simple maintenance tasks such as cleaning the station area and cutting surrounding grass are carried out regularly, particularly in light of the limited number of SLMet staff available to perform these duties.

At the national level, there is currently no WIGOS (WMO Integrated Global Observing System) mechanism, nor any formal process for responding to quality-related information received through the WMO Data Quality Monitoring System (WDQMS).

3.4 Implementation of sustainable newer approaches to observations.

There is no National WIGOS Implementation Plan adopted.

Beyond providing conventional weather warnings, seasonal outlooks, and limited flood forecasts, SLMet's capacity to predict other hazards remains highly constrained due to insufficient equipment and limited technical capacity of personnel.

3.5. Percentage of surface observations that depend on automatic techniques.

Approximately 88.5% of SLMet's observing network is based on automated systems. However, the lack of continuous internet subscriptions significantly limits the effective operation and real-time data transmission of these stations.

Summary score, recommendations, and comments for Element 3

In summary, Sierra Leone operates with a limited operational observational network, which makes it challenging for the country to fulfil its meteorological mandate. These limitations stem from a lack of sustainable financial resources, technical equipment, and the restricted availability of trained personnel, which is why the **Maturity Level for Element 3** only reaches **2** out of 5.

To build a stable and sustainable observational network that can also meet GBON requirements in the future, the development and implementation of Standard Operating Practices (SOPs) should play a central role. However, it must be noted that there is a significant shortage of trained personnel as well as of equipment and financial resources necessary to implement these plans effectively.

Therefore, it is crucial that the importance of the national meteorological service and its functions is more widely recognized at the government level, so that it can be elevated in national priorities. This would enable the allocation of additional budget and personnel, allowing the service to operate and maintain a more comprehensive observational network, expand its capacity to provide a broader range of services — including warnings for multiple hazards — and fully fulfil its mandate.

Element 4: Data and product sharing and policies

4.1. Percentage of GBON compliance – for how many prescribed surface and upper-air stations are observations exchanged internationally. Usage of regional WIGOS centres.

Even though there are currently 14 synoptic surface stations registered in OSCAR, none of those stations are currently sharing data internationally. As already discussed in the previous chapter, the country does not operate any upper-air stations. Only 7 out of the 14 registered are operational but not yet GBON compliant.

Sierra Leone will be assigned to one of the Regional WIGOS Centres (RWC), that are planned to be established, to cover all African countries by 2026.

4.2. A formal policy and practice for the free and open sharing of observational data.

As of March 2026, the WMO Regional Office for Africa (WMO-RO) is supporting SLMet in implementing ClimWeb, installing an Automated Data Loader (ADL) system, and deploying a WIS 2.0 node. The ADL is designed to address challenges arising from heterogeneous weather stations and varying data formats by enabling the standardization and automation of data collection and transmission.

Despite these advancements, observational data are not yet shared internationally and are currently exchanged between government agencies only upon request. At present,

observations from six stations are shared informally via a WhatsApp group at 09:00, 12:00, and 17:00 local time. Data from two stations in Lungi are accessible through the manufacturer's Data Dashboard, while observations from other stations are recorded manually on paper. These are transmitted at the end of each month via text message or phone call, then manually entered into Excel spreadsheets and stored on a local server.

SLMet staff have received training from the UK Met Office on the use of real-time data and have been supported in the development of standard operating procedures (SOPs).

Data backup is currently managed through a mirroring process to a secondary server. However, both servers are located at the same site, creating a significant risk of data loss in the event of incidents such as fire or other physical damage. Additionally, the existing servers are outdated and nearing their storage capacity limits. Relocating the secondary server to SLMet's second office would reduce this risk. In the longer term, upgrading the server infrastructure is recommended, ideally incorporating a cloud-based backup solution. To date, the digitization of historical records has been carried out only on a limited and sporadic basis.

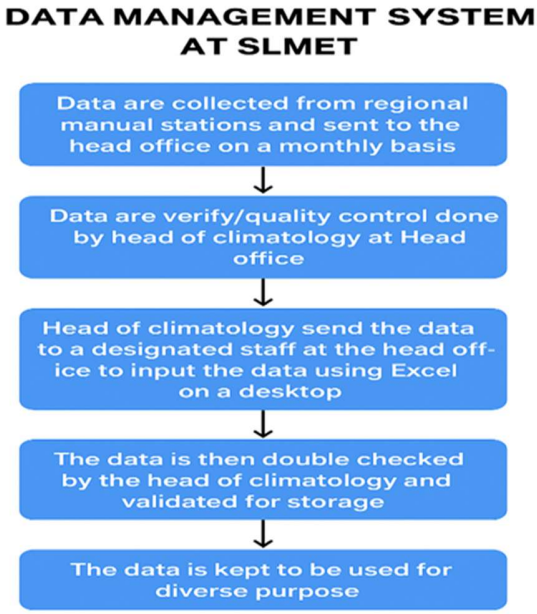

Figure 6: Illustration of SLMet's current data management system process (source: SLMet 2025)

Stage	Description	Tools/Actors
1. Data Collection	Rainfall readings from stations (e.g., Tower Hill, Makeni, Kenema, Kono); Observed data; farmer observations	Field technicians, observers

2. Data Entry & Storage	Manual or automated input into Excel, climate databases and Python scripts	Data clerks, analysts
3. Quality Control & Validation	Check for missing values, outliers, and consistency across sources	Analysts, SOPs
4. Data Processing & Analysis	Calculate rainfall totals, anomalies, trends; generate visuals like bar charts	Python, Excel, climatological methods
5. Product Generation	Create bulletins, advisories, charts (e.g., rainfall pattern graphic)	Technical advisors, graphic tools
6. Dissemination & Feedback	Share via WhatsApp, radio, extension services; gather farmer feedback	Outreach teams, stakeholders

Figure 7: Description of SLMet's current data management system process

SLMet's current data workflow relies heavily on manual collection, access, and processing using Excel and Python scripts, with decentralised storage. Observations from stations and farmer reports are manually validated, processed, and transformed into bulletins or advisories, which are then disseminated via WhatsApp, radio, and extension services. Data from automated stations are being compared to the measures of manual stations.

The absence of a modern database management system (DBMS) limits real-time integration, automated quality control, and efficient analysis.

Currently, there are no formal agreements or interagency protocols between relevant entities such as NWRMA in place for the systematic exchange of monitoring data or baseline information necessary to produce data products for priority hazards. Data sharing between institutions occurs on an ad hoc basis, typically upon request and without standardized procedures or automated systems. As a result, the integration of meteorological, hydrological, and other hazard-related data remains limited, constraining the country's ability to produce comprehensive, multi-hazard early warning products. As a result, it was concluded to sign a MoU with EPA, NWRMA, Civil aviation. NDMA, NWRMA and SLMET have expert meetings on a regular basis.

The Sierra Leone Ministry of Environment and Climate Change is currently in the process of developing **a comprehensive data platform intended to collect and integrate data from all relevant ministries and governmental institutions** in order to facilitate improved data sharing and more timely alerting. An associated roadmap for the development and implementation of this platform is expected to be prepared in the coming months.

4.3. Main data and products received from external sources in a national, regional and global context, such as model and satellite data.

SLMet formerly operated a satellite receiving station at its office in Lungi International Airport; however, it is currently offline due to space constraints. Negotiations for additional office space within the airport building are ongoing and are expected to be resolved soon. In the meantime, SLMet relies on the EUMETView web portal to access basic satellite data visualizations, which are validated using observations from local stations.

SLMet's staff are trained in accessing and interpreting remote-sensing data for all priority hazards[3,] but only use it for rainfall intensity, wind, and thunderstorm and lightening detection. They received training from the UK Met Office WMO, Agrhymet, ACMAD, and a SOP is in place to guide their work.

At the national level, the NWRMA shares data on groundwater levels and surface water stations (including water levels and precipitation) with SLMet. Manual data are collected by 48 community staff through water level readers, who record water levels three times a day and transmit the information to NWRMA via text message. Data from automatic surface stations are transferred via telemetry, while groundwater stations transmit data directly to a server using the TCP/IP protocol. However, for both surface water stations and groundwater stations, only a limited number of available stations are operational (see 8.1).

Regarding connectivity, SLMet faces significant challenges due to limited and unstable internet bandwidth. The government currently provides a connection of 10 Mbit/s for both download and upload. This is temporarily supplemented by an external project providing an additional 60 Mbit/s download and 50 Mbit/s upload capacity. However, these additional resources are available only for a limited period of time and therefore do not constitute a sustainable long-term solution.

Summary score, recommendations, and comments for Element 4

SLMet currently relies on manual data collection, with limited quality control, delayed processing, and no formalized data-sharing mechanisms. Observations from surface stations are not shared internationally, and interagency data exchange occurs only on an ad hoc basis. In addition, access to satellite data remains constrained due to the offline PUMA station and limited connectivity.

While initial steps toward modernization have been taken—including the installation of ClimWeb and a WIS 2.0 node - international data sharing has not yet commenced. Given these constraints, **Element 4 is assessed at Maturity Level 1**, primarily due to the absence of systematic international data sharing.

To address these gaps, it is recommended that SLMet establish formal data-sharing agreements and interagency protocols and implement a centralized database management system (DBMS), complemented by digital field data collection tools such as Open Data Kit (ODK). Strengthening connectivity and establishing a robust backup system will also be critical.

Effective data and product-sharing policies and processes are integral to the country's pathway toward achieving GBON compliance, which is a central objective of the United Nations' Systematic Observations Financing Facility (SOFF). Accordingly, the SOFF programme will support these measures, with particular emphasis on enabling and operationalizing international data sharing.

[3] Drought/Dry spell; flash-floods; landslide; dust; strong wind

Element 5: Numerical model and forecasting tool application

5.1. Model and remote sensed products form the primary source for products across the different forecasting timescales.

SLMet relies on a combination of observational data and Numerical Weather Prediction (NWP) models in the form of meteograms, which is accessed via Windy[4]. This includes data from the European Centre for Medium-Range Weather Forecasts – Integrated Forecasting System (ECMWF-IFS, spatial resolution of 9 kms, but since used only via website, the time resolution is of 3 hours), MeteoBlue (not a gridded model, hence no spatial resolution. 3 hours), the Deutscher Wetterdienst (DWD) ICON model[5] (13 kms and 3 hours), Global Forecast System (GFS, 13 kms and 3 hours, respectively), the African Integrated Forecasting System (AIFS, 28 kms and 3 hours), the UK Met Office Tropical Africa model (4.4 kms and hourly), and EUMETSAT satellite products—to support forecasts across multiple timescales. Many of these products are part of the WMO Severe Weather Forecasting Programme (SWFP). SWFP products from the African Centre of Meteorological Application for Development (ACMAD Regional Climate Centre (RCC) Africa) and the Regional Centre for Agrometeorology and Operational Hydrology (AGRHYMET) are used to validate SLMet's own data and forecasts.

SLMet's forecasters use mostly only graphs, meteograms, and other basic visualizations. While these external sources support short-term, medium-range, and seasonal forecasts of rainfall, temperature, and flood risk, SLMet does not operate its own regional models nor perform any post-processing of GRIB-format model products. This limits its ability to produce high-resolution, location-specific forecasts.

Satellite imagery is accessed via the EUMETView web portal. Due to previous equipment damage, SLMet currently lacks an operational weather radar, which limits its ability to monitor and validate severe weather events in real time.

SLMet's capacity is further constrained by the limited training of staff in accessing and using products from the World Meteorological Centre (WMC)/Regional Centre (RC), and guidance for forecasting hazards. SLMet has indicated that access to global and regional center products has not significantly improved in recent years, leaving staff with limited capacity to fully utilize these resources.

5.2. a) Models run internally (and sustainably), b) Data assimilation and verification performed, c) appropriateness of horizontal and vertical resolution.

Currently SLMet does not run regional models on their own.

5.3. Probabilistic forecasts produced and, if so, based on ensemble predictions.

SLMet produces probabilistic forecasts primarily in support of aviation operations, while deterministic forecasts remain the predominant format for general public dissemination. The SLMET does not operate its own Ensemble Prediction System (EPS) but utilizes outputs from the ECMWF EPS to inform its forecasts and assess associated uncertainties.

Summary score, recommendations, and comments for Element 5

[4] Professional account
[5] Icosahedral Nonhydrostatic

In summary, SLMet relies primarily on web visualisations of external Numerical Weather Prediction (NWP) models and satellite data to produce deterministic forecasts across short-term, medium-range, and seasonal timescales. Forecasting operations are currently conducted with a lead time of approximately one hour for forecast horizons of four to five hours, with plans to extend this to six hours. At present, continuous 24/7 forecasting operations are only maintained at Lungi International Airport.

Forecasts for the rest of the country are issued daily at 18:00, based on comparisons of outputs from various NWP models and the limited observational data available locally. Observations from manual stations are typically available only during daytime hours, generally until 18:00. SLMet's **maturity level** for numerical modelling and forecasting tool application is assessed at **Level 2**. Overall forecasting capacity remains constrained by limited staff expertise, restricted integration and availability of real-time local observational data, and incomplete infrastructure, including the absence of weather radar and radiosonde systems.

To overcome the current limitations, it is recommended to strengthen the capabilities of the existing CLIMWEB platform so that it can visualise both global and regional model outputs more effectively. All relevant SLMet staff—e.g., forecasters, and climatologists —should be granted full access to this software. Expanding the internet-bandwidth provision will enable automatic reception of GRIB files from the various models. The system should also be used to present the different observations (remote-sensing and in-situ) for a comprehensive overview.

In a summary, in the short term, the first two stages should be:

a) through SOFF and other initiatives, ensure that existing and future surface stations are capable of providing real-time data to SLMet; and

b) establish a programme of continuous training for the relevant personnel to improve the use of the already existing model products.

In the long term, allocating staff to create basic post-processing products.

Given the limited human resources of SLMet, it is not recommended to invest in the operation and running of local models at this stage.

Element 6: Warning and advisory services

6.1. Warning and alert service cover 24/7.

The country currently lacks an operational 24/7 alert service and does not have a Multi-Hazard Early Warning System (MHEWS) or a comprehensive monitoring and forecasting system capable of addressing multiple simultaneous or cumulative hazards. Existing warning mechanisms are limited in scope, primarily focused on the capital city and covering only about 20% of its population. Currently, the lead time for warnings ranges from a minimum of 1 hour to a maximum of 3 hours, meaning that no effective early warning system is in place.

6.2. Hydrometeorological hazards for which forecasting and warning capacity is available and whether feedback and lessons learned are included to improve warnings.

Currently, the only warnings issued are for riverine floods, and there is neither user feedback mechanism in place nor a cross-border exchange of warnings with neighboring countries. Flood warnings are communicated by SLMet to the National Disaster Management Agency (NDMA) and the NWRMA, who are responsible for disseminating them to the public, using channels such as WhatsApp Groups or Facebook. However, it was mentioned that using text messages would be better due to the abundance of smartphones and/or internet in various regions. A dedicated Flood Task Team—comprising personnel from SLMet, NDMA, and NWRMA—has recently been established to coordinate flood-related activities, utilizing the Flash Flood Guidance System and operating under an established SOP for issuing flood warnings. The group facilitates internal coordination of warnings and alerts, ensuring that each stakeholder can take the necessary actions and reach an internal agreement before any information is released to the public. Post-disaster analysis is done by NDMA in cooperation of SLMet for certain events. Currently, the operational area is limited to Freetown, where a precipitation threshold for issuing flood warnings has already been developed. There are plans to expand this system nationwide in the future. In addition, efforts are ongoing to establish a centralized warning system that can automatically disseminate alerts across multiple channels, reducing the reliance on manual communication through WhatsApp groups, emails, and other channels. This is expected to significantly improve the reach, efficiency, and timeliness of early warnings to the public.

So far, there are no fail-safe systems in place.

6.3. Common alerting procedures in place based on impact-based services and scenarios taking hazard, exposure and vulnerability information into account and with registered alerting authorities.

In March 2026, SLMet issued its first Common Alerting Protocol (CAP) warning via its website as part of a training course implemented by the WMO Regional Office (WMO-RO), including simple instructions for the population on how to reduce risk.[6] However, it may take some time for this to become common practice, as no further CAP warnings have been issued since the training course.

SLMet does not provide impact-based forecast and warning services, and its forecasters have not been trained in the principles, methods, or applications of impact-based forecasting (IBF). However, following user feedback, SLMet revised its daily weather forecasts by shifting from quantitative to qualitative descriptions, using categories such as *cold*, *mild*, *hot*, and *very hot* instead of numerical temperature values.

In addition, partial collaborations exist between SLMet and civil society organizations (CSOs) to support the dissemination of warnings and preparedness efforts, particularly in remote areas. For example, the organization GOAL works with fisherfolk and coastal communities to identify areas vulnerable to flooding and sea level rise, and to raise awareness accordingly. Additionally, they provide training to fishermen and rescue groups on safety measures, including guidance on when it is safe to go to sea. Marine forecasts are shared via a dedicated WhatsApp group to ensure timely communication.

Summary score, recommendations, and comments for Element 6

[6] Dust Condition Continues Over Freetown (05/03/2026)

SLMet's warning and advisory services are currently assessed at **Maturity Level 2**. Operational 24/7 alerts are not yet in place, and warnings are limited to floods in the Freetown area, with lead times of 1–3 hours. Dissemination relies heavily on informal channels, including WhatsApp and social media. CAP alerts and systematic user feedback mechanisms are in the early stages of development and will require further institutionalization. Trust in weather warnings among the population remains limited; to address this, the Deputy DG of SLMet has participated in religious radio programmes to raise awareness.

Strengthening cooperation and engagement with CSOs and the NDMA could further enhance the maturity and reach of warning systems. Community-based approaches, such as the use of colored cloths or banners, may complement formal mechanisms, while trusted local actors—including pastors, elders, and spiritual leaders—can strengthen credibility and encourage the uptake of warnings. Expanding communication channels through radio programming and partnerships with telecommunication providers would support broader dissemination. The effectiveness of warning and advisory services could be further enhanced by operationalizing thresholds for warnings nationwide and establishing structured feedback mechanisms. At the same time, sustaining trust in these systems requires consistent and predictable communication. Newly established information channels (e.g., WhatsApp channels or websites) should be maintained and regularly updated. While forecasts and CAP messages are disseminated periodically, irregular posting may undermine user confidence. Regular updates, including during periods without significant events, would help establish these platforms as reliable and authoritative sources of information.

Element 7: Contribution to climate services

According to the IPCC's Sixth Assessment Report (AR6), West Africa is expected to experience increasingly severe climate change impacts by the middle of the 21st century, particularly if global warming exceeds 2°C above pre-industrial levels. Observational data already show a rise in riverine flooding across the region, along with drying trends that have contributed to more frequent and intense agricultural and ecological droughts.

Projections under a 4°C Global Warming Level (GWL) scenario indicate a marked increase in meteorological droughts, especially on seasonal timescales. Such droughts are likely to intensify stress on agriculture, water availability, and rural livelihoods. In addition to drought-related risks, climate models also project an increase in mean wind speeds and a higher frequency of heavy precipitation events, which are expected to cause more pluvial flooding.

Sierra Leone's economy is heavily dependent on agriculture (25.4% of GDP7), a sector that is highly vulnerable to the expected impacts of climate change, threatening the livelihoods of many people. Therefore, climate services that support people and climate-sensitive sectors in the adaptation and mitigation of climate change are of major importance.

7.1. Where relevant, contribution to climate services according to the established capacity for the provision of climate services.

In Sierra Leone, climate change adaptation is addressed by several key institutions, including the Ministry of Environment and Climate Change, the Environmental Protection Agency (EPA),

[7] as of 2024: Sierra Leone | Data

and SLMet, whose Deputy Director-General also serves as the national United Nations Framework Convention on Climate Change (UNFCCC) Focal Point. The EPA has made adaptation a central part of its mandate, dedicating one of its three strategic pillars to "navigating the climate crisis with resilience, adaptation, and innovative solutions[8]".

The National Framework for Climate Services (NFCS) is designed to promote cross-sectoral coordination and support the development of climate-informed policies and actions that are responsive to national priorities and circumstances. NFCSs play a vital role in helping countries that are party to the Paris Agreement to prepare, maintain, and communicate their Nationally Determined Contributions (NDCs). Additionally, the NFCS complements the implementation of National Adaptation Plans (NAPs) by contributing to medium- and long-term adaptation planning through the identification of climate vulnerabilities and the formulation of appropriate response strategies.

Ultimately, the NFCS aims to improve understanding of climate risks and impacts, while enhancing the institutional and technical capacity for climate-resilient planning and implementation across climate-sensitive sectors, such as agriculture, water resources, health, and disaster risk management.

Sierra Leone is currently at Step 1 of 5 in the process of establishing a National Framework for Climate Services (NFCS). This initial stage focuses on assessing the national baseline of climate service capacities, identifying key stakeholders—both users and providers—mapping existing climate-related services, and evaluating institutional and technical capabilities.

Furthermore, SLMet provides seasonal outlooks (see Annex 5) and climate bulletins on request, e.g., information on the onset of the rainy season or predicted length of the rainy season; temperature outlooks serving WHO guidelines.

Summary score, recommendations, and comments for Element 7

Historical weather and climate records are available only to a limited extent, both in terms of temporal coverage and continuity, and digitization is still in progress. These limitations constrain the ability to produce long-term time series and conduct comprehensive hazard assessments. However, preserved historical data are used by SLMet for statistical analysis, to observe trends, produce seasonal outlooks and trends, prototype machine learning models and climate projections. User groups of these data are e.g. construction companies, industrialized farmers, government agencies, and UN agencies.

Climate projections and climatic analyses are regionally done by ACMAD, AGHYMET and the WMO regional office.

Although clear efforts are being made to provide climate services, most of these remain basic or below basic. There are no user interfaces that allow for feedback or interaction between providers and users. Monitoring and evaluation mechanisms to assess socio-economic benefits are also lacking.

For these reasons, a **Maturity Level of 1 is assigned for Element 7.**

Future prospects should focus on closer coordination with stakeholders to address their needs through SLMet's climate services. Developing detailed cropping and planting calendars with

[8] https://epa.gov.sl/epa-strategic-focus/

the Ministry of Agriculture, Forestry, and Food Security could enhance the relevance and utility of these services. This further aligns with Step 2 of the National Framework for Climate Services (NFCS), which emphasizes assessing user needs and co-developing tailored climate products.

Element 8: Contribution to hydrology

In recent years, Sierra Leone has experienced severe natural hazards with major human and economic losses, notably, the catastrophic landslide of 2017 left 1,100 people dead or missing, the Freetown flash floods in 2019[9] and extensive floodings in 2024, affecting 1,500 farmers. [10] The World Bank Climate and Health Vulnerability Assessment for Sierra Leone[11], conducted in 2023, highlights a growing trend in the frequency of catastrophic flooding events, with nine major incidents recorded since 2004. While overall net precipitation is projected to decline, the intensity of rainfall during the rainy season is expected to increase, further exacerbating flood risks. Freetown is identified as one of the most vulnerable locations, with approximately 10 percent of the city's population living in high-risk zones.

Other observable and projected impacts of climate change include a significant lengthening of the wildfire season and an increased risk of droughts, both of which are likely to further aggravate existing food insecurity and malnutrition in Sierra Leone by putting people's livelihoods—particularly those dependent on agriculture and natural resources—at risk.

8.1. Where relevant, standard products such as quantitative precipitation estimation and forecasts are produced on a routine basis according to the requirements of the hydrological community.

The field of operational hydrology in Sierra Leone is administratively separated from the SLMet and falls under the responsibility of the NWRMA, with which SLMet however maintains a strong, though not formalized, collaboration.

The NWRMA was formed in 2017 by Act No. 5 of Parliament and is mandated with the sustainable management of Sierra Leone's water resources.

However, the agency is operating with very limited capacity. Currently, only 12 of the 28 surface water stations are operational. Of the 32 groundwater monitoring stations, 17 are currently offline due to vandalism and insufficient resources for maintenance

Data from surface water stations are directly transmitted to EUMETSAT. A server from NWRMA then withdraws the data from the EUMETSAT database. Groundwater stations usually transmit data directly to a server using mobile data and the TCP/IP protocol.

Manual data collection is conducted three times a day by trained gauge readers in 48 communities. They transmit the data to NWRM via text messages daily. The Flood Task Team uses these data for analysis and flood-warning decisions

[9] NDPBA_SLE_Final_Report.pdf, p. 4
[10] Sierra Leone: Floods - Sep 2024 | ReliefWeb
[11] World Bank Document

8.2. SOPs in place to formalize the relation between Met Service and Hydrology Agency, showing evidence that the whole value chain is addressed.

Although no formal Standard Operating Procedure (SOP) is currently in place, coordination between the two agencies takes place on an ad hoc basis and is supported by a strong working relationship. This collaboration has been further strengthened by the recently established Flood Task Team described in Chapter 6.2. It was also noted that a Memorandum of Understanding (MoU) between the two institutions is currently under development.

8.3. Data sharing agreements (between local and national agencies, and across international borders as required) on hydrological data in place or under development.

As mentioned above, data sharing between the NWRMA and the SLMet currently takes place on an ad hoc basis and relies largely on strong working relationships between the institutions. However, the previously mentioned initiative of the Sierra Leone Ministry of Environment and Climate Change to establish a comprehensive data platform is expected to further facilitate and institutionalize data sharing between the two agencies.

On an international level, there are currently no formal data-sharing agreements in place across national borders. This poses a major challenge, as the lack of information from riparian states hinders timely flood forecasting and response. The floods of 2024, which originated in Guinea, clearly demonstrated the consequences of limited cross-border data exchange. Establishing coordination mechanisms within the Mano River Union basin, for example, could significantly improve access to upstream hydrological data and support more effective early warning and disaster response.

8.4 Joint projects/initiatives with hydrological community designed to build hydrometeorological cooperation.

Between 2013 and 2021, the Sierra Leone Rural Water Supply and Sanitation Project, funded by the African Development Fund, provided, among other assets, 60 automatic rainfall gauges to SLMet.

Summary score, recommendations, and comments for Element 8

The country's contribution to hydrology is characterized by an increasing but still informal level of collaboration between SLMet and the NWRMA. While coordination between both institutions functions effectively on an ad hoc basis—supported by the newly established Flood Task Team—the absence of formalized SOPs, data-sharing agreements, and integrated operational mechanisms continues to limit systematic cooperation. Hydrological monitoring remains weak, with few surface water stations functioning and all groundwater stations currently offline, resulting in incomplete and delayed data flows. The lack of cross-border data exchange, particularly within the Mano River Basin, further constrains timely flood forecasting and response, as demonstrated by the 2024 floods originating in Guinea. To advance beyond its current **Maturity Level** of **3**, efforts should focus on formalizing institutional cooperation, rehabilitating of hydrological stations, strengthening data integration, and fostering regional coordination and information exchange to enhance flood early warning and water resource management capacities.

Element 9: Product dissemination and outreach

9.1. Channels used for user-centred communication and ability to support those channels (for example, does the NMHS operate its own television, video or audio production facilities? Does it effectively use cutting-edge techniques?).

SLMet currently uses a range of communication channels to reach its users, including WhatsApp groups and channels, television and radio broadcasts, Facebook and LinkedIn. Communication with the NDMA is mainly conducted via email, and during emergencies, through direct phone calls.

Through the support of the WMO Regional Office for Africa, a ClimWeb platform has been established to strengthen SLMet's online communication. The platform serves as a central hub for disseminating weather and climate information to the public and key stakeholders, offering enhanced data visualization and simplified website management. Its key features are designed to support impact-based forecasting, multi-sectoral analysis, real-time data integration, and the publication of CAP alerts.

In Sierra Leone, the SLMet website has recently gone online and currently provides mainly basic products, including daily, decadal, and seasonal weather and marine forecasts, which are updated irregularly. Notably, in March 2026, the country's first CAP warning was issued via the website. Once fully operational, it is expected to substantially enhance user-centered communication by improving accessibility, visibility, and the timely delivery of weather forecasts, warnings, and climate services nationwide.

At present, weather warnings are primarily disseminated through WhatsApp groups, direct phone calls, and occasional television broadcasts. To strengthen outreach in remote coastal communities, a UNDP-supported initiative has distributed smartphones, helping improve communication channels and ensure faster access to early warnings in high-risk areas.

9.2. Education and awareness initiatives in place.

Despite the above-mentioned efforts, education and awareness initiatives remain limited. Activities have so far included a few rural seminars for farmers, mainly focused on seasonal forecasting and agricultural planning, as well as disaster risk training for communities located downstream of dams. Looking ahead, there are ambitions to transition from text-based alerts to a color-coded warning system and to partner with telecommunication providers to establish a more structured, accessible national warning service. Additionally, through the Agricultural Value Chain Development Project (AVDP), extension officers in Bo District have received training in climate-smart agriculture, equipping them to support local farmers in adapting their practices to a changing climate.[12]

9.3. Special measures in place to reach marginalized communities and indigenous people.

There are currently no special measures in place to reach marginalized communities. However, interviews with CSOs and the NDMA have revealed several ideas to improve communication with these groups. These include the use of local languages in warning messages, the involvement of community radio, and the training of local focal points within communities. One practical approach already used for marine forecasts involves displaying

[12] Agricultural Value Chain Development Project

cloths in different colors on the landside, which could also be adapted for storm warnings—for example, red to indicate "do not go to sea," orange for "exercise caution," and green for "safe to go." Additionally, the engagement of women groups and youth in awareness activities was highlighted. While these ideas are not yet formalized or implemented, they reflect an existing awareness and willingness among key actors to enhance inclusion and accessibility in early warning dissemination.

Summary score, recommendations, and comments for Element 9

In summary, Sierra Leone continues to face significant challenges in ensuring the timely and effective dissemination of warnings to the public, particularly in remote and last-mile communities. Access to information remains constrained by limited internet connectivity, smartphone availability, and language or literacy barriers, which collectively reduce the reach and impact of warning messages.

Despite these challenges, notable progress has been made with the establishment of the ClimWeb platform, which provides accessible and visualized weather and climate information to the public. Ongoing efforts to strengthen outreach and develop innovative approaches to reach remote communities demonstrate encouraging early progress.

Based on the current level of development, the **Maturity Level for Element 9** is assessed **at Level 2**. To advance further, it will be essential to fully operationalize and expand these initiatives, ensuring that communication and early warning systems become more inclusive, accessible, and capable of reaching all segments of the population.

Element 10: Use and national value of products and services

10.1. Formalized platform to engage with users in order to co-design improved services.

Services provided by SLMet remain largely limited to basic public services, including general weather and climate information as well as warnings. Further services are limited to aviation.

The national Flood Task Team currently represents the only formal national committee for coordinating Disaster Risk Reduction activities from the national to sub-national level. Comprising SLMet, NDMA, and NWRMA, the committee conducts activities including post-event analysis but is limited in scope to a single hazard: floods.

SLMet currently does not have an established mechanism for the co-design or co-production of tailored products and services with users. Similarly, no studies on the social and economic benefits (SEB) of weather, climate, or hydrological services have been undertaken in the last 10 years.

10.2. Independent user satisfaction surveys are conducted, and the results used to inform service improvement.

Although no independent user satisfaction surveys had been conducted previously, in March 2026 SLMet published its first online satisfaction survey via its WhatsApp channel and website. In the past, SLMet had organized focus group discussions with users—primarily farmers—as a means of gathering feedback on its products.

10.3. Quality management processes that satisfy key user needs and support continuous improvement.

A Quality Management System (QMS) for international air navigation is currently developed with support from WMO and the UK Met Office. Policies are being developed and dedicated staff are being appointed, with the aim of achieving full QMS implementation and successful certification in 2026.

Summary score, recommendations, and comments for Element 10

In summary, user engagement and service development at SLMet are at an early stage, corresponding to a **Maturity Level of 2 for Element 10.** Services remain largely limited to basic weather information and warnings, with tailored services primarily provided for aviation. There is no formal mechanism for systematic user engagement or co-design, and existing coordination structures (e.g., the Flood Task Team) are limited to a single hazard.

User feedback processes are largely ad hoc, although the launch of an online satisfaction survey in March 2026 represents a positive initial step. No recent socio-economic benefit (SEB) studies have been conducted. Progress is being made in quality management, with a QMS under development for aviation, but this has not yet been extended to other service areas.

To progress to a higher maturity level, user feedback mechanisms should be institutionalized through regular satisfaction surveys and structured engagement processes, enabling evidence-based and user-tailored service development. Multi-sectoral engagement platforms should be established and existing coordination mechanisms expanded from a single-hazard to a multi-hazard approach with nationwide coverage. Finally, the implementation of the aviation QMS should be completed, with a view to progressively extending quality management practices across all service areas.

ANNEXES

Annex 1 Consultations (including experts and stakeholder consultations)

Institution	Designation	Contact Person
Civil Aviation Authority	Director General	Musayeroh Barrie
GOAL	Program Coordinator – Blue Economy, Food Security and Livelihood	Benjamin Bockarie
Ministry of Agriculture and Food Security	Deputy Minister 1	Hon. Dr. Theresa T. Dick
Ministry of Environment and Climate Change	Minister	Jiwoh Abdulai
Ministry of Transport and Aviation	Minister	Amb. Alhaji Fanday Turay Esq.
NDMA	Director General	Lt. Gen. (Rtd) Brima Sesay
NDMA	Deputy Director General	John Rogers
NWRMA	Director General	Junisa Patrick Bangali Esq
NWRMA	Director-hydrological Services	Mohamed Sahr E. Juanah
NWRMA	Director of Planning, Research and Operation	Tiideni hawa Jabbi
SLMet	Director General	Ibrahim Sinneh Kamara
SLMet	Deputy Director General and Head of Operations	Gabriel Kpaka
Sierra Leone Red Cross Society (SLRCS)		
UNDP		
UNDP		
WFP	Country Director (Rtd.)	Yvonne Forsen
WFP	Country Director (as of September 2025)	Andrew Odero
WFP	Deputy Country Director	Aminata Tall
WFP	Head of Partnerships & Communications	Alan Awimbo
WFP	Emergency Preparedness and Response Officer	Francis Rogers
WFP	Sustainable Food Security & Livelihood Project Manager	William Hopkins

Annex 2 Urgent needs reported

The summary at the end of each element provides a good overview of the gaps identified and the actions required. The following section provides a condensed summary of the most urgent needs identified throughout all the elements:

1. Financial constraints and human resource limitations

SLMet operates under significant financial constraints, relying heavily on delayed and often insufficient ministerial funding. The absence of a cost recovery mechanism further limits financial stability and long-term planning capacity. This affects the agency's ability to secure essential operational resources, including ICT infrastructure, station maintenance, data backup systems, and staff development.

These financial limitations contribute to a shortage of qualified personnel, low staff retention, and high turnover, driven by limited training opportunities and low remuneration. Strengthening the communication of the socio-economic benefits of weather, climate, and hydrological services is essential to support increased investment and prioritization.

2. Maintenance, operations, and data management (including GBON requirements)

To build a stable and sustainable observational network that meets GBON requirements, the modernization and extension of the current network as well as the development and implementation of Standard Operating Procedures (SOPs) should play a central role. However, there is a significant shortage of trained personnel, equipment, and financial resources required to effectively implement these measures.

The same applies to data transmission and data management. Reliable implementation is only possible if uninterrupted data transmission is secured, alongside strengthened data quality control, management systems, and adequately trained staff capable of processing and analysing data in line with GBON standards.

3. Early warning systems, climate services, and user engagement

In Sierra Leone, there is no early warning system currently in place. Of five priority hazards, only flooding is partially covered, and only for the capital region, leaving large parts of the population unprotected. CAP-based alerting and structured user feedback mechanisms are still in early development stages and require institutional strengthening.

Climate services remain basic, limited by gaps in digitized historical data and loss of observations, as well as insufficient understanding of user needs. Engagement with users is still limited, although initial steps have been taken. These mechanisms need to be formalized and institutionalized to build trust and improve service relevance. Furthermore, SLMet should expand its reach to ensure nationwide coverage and more inclusive service delivery.

Annex 3 Information supplied through WMO

- WMO Global GBON Gap Analysis
- WMO WIGOS Data Quality Monitoring System
- WMO Observing Systems Capability Analysis and Review Tool

Annex 4 List of materials used

National Framework for Climate Services

CREWS 2025: CREWS-ASW-Sierra-Leone-Project-Final-Report.pdf

World Bank Group (2025). Climate Change Knowledge Portal — Sierra Leone climate data (1991–2020). Retrieved from World Bank Climate Change Knowledge Portal.

Annex 5 Example of Dry Seasonal Outlook 2025

Dry Seasonal Outlook January-April 2025

SLMet Sierra Leone Dry Seasonal Outlook (January to April 2025)

1. Introduction

This document provides a detailed dry seasonal outlook for Sierra Leone, covering January to April 2025. It includes temperature trends, dust forecasts, potential risks, and actionable recommendations. The projections are based on SLMet's historical data, meteorological models, and global climate patterns such as the El Niño-Southern Oscillation (ENSO).

The 2025 dry season projection poses significant challenges due to above-average temperatures and associated risks. However, coordinated efforts among government, private sector, and communities will be essential to mitigate the impacts and ensure resilience. Thus, SLMet will continue to provide timely updates and guidance to support national planning.

2. General Overview of January, February, March and April 2025 Temperature Predictions

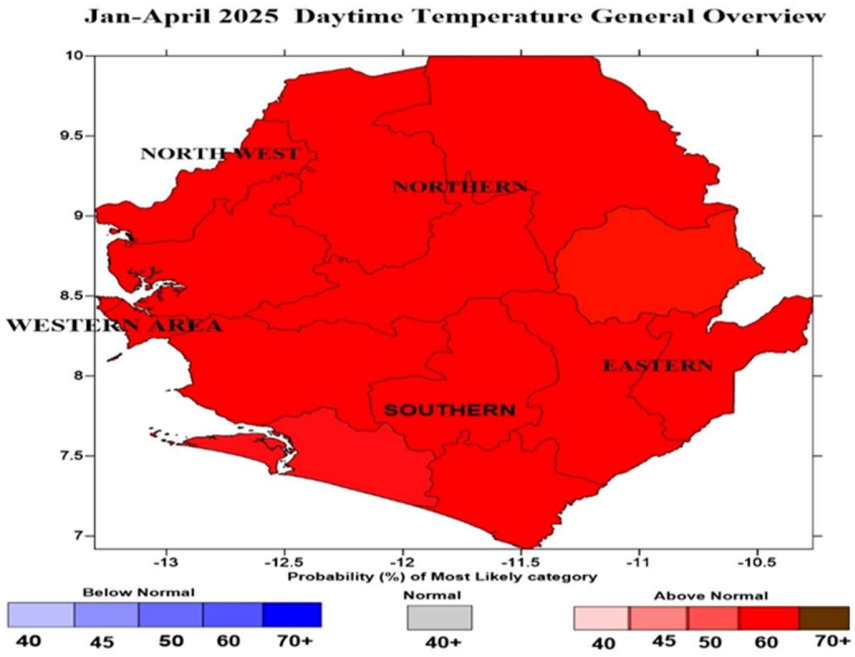

Figure 1: Jan - Apr 2025 Temperature prediction

The 2025 dry season is expected to be hotter than average, influenced by ongoing El Niño conditions as depicted in figure 1 above. The daytime temperatures are predicted to range between **28°C and 40°C** across most regions, with the northern and northeastern parts experiencing the highest extremes. However, the nighttime temperatures will remain relatively warm, averaging **22°C to 26°C**.

3. Regional Temperature Highlights

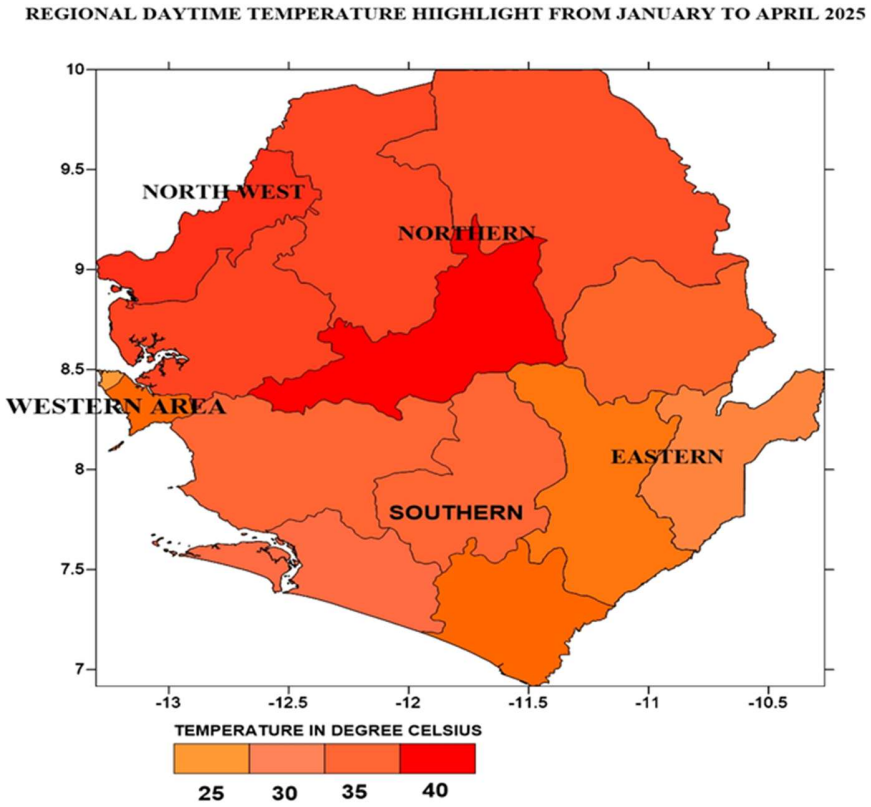

Figure 2: Jan-Apr 2025 Regional Daytime Temperature prediction

From figure 2 above:

- **Western Area (Freetown and Coastal Areas):** Daytime temperature around 30°C to 34°C; humidity levels remain elevated, exacerbating heat stress.
- **Northern Region:** Daytime temperature between 35°C and 39°C, with significant nighttime cooling challenges.
- **Eastern Region:** Daytime temperature ranging from 28°C to 33°C, with potential for isolated heat waves.
- **Southern Region:** Daytime temperature will account moderate temperatures from 29°C to 34°C

4. Dust Prediction

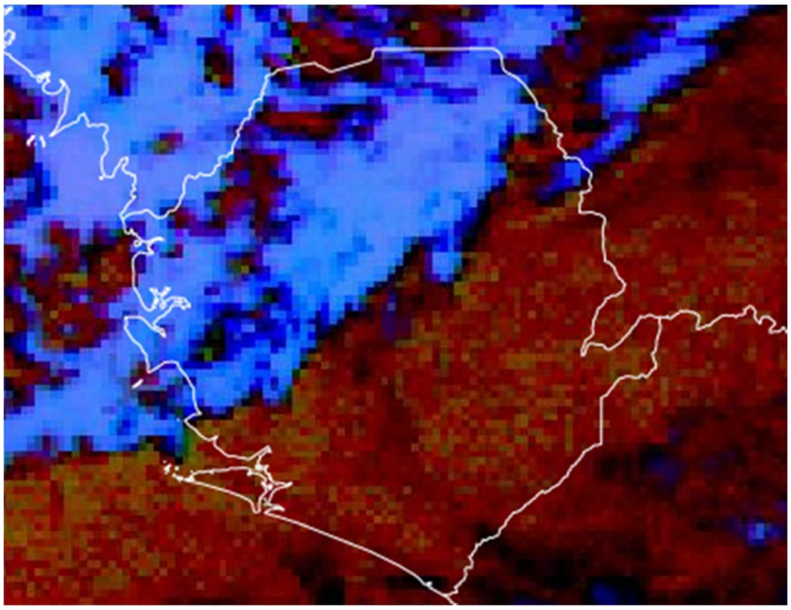

Figure 3: Predicted Jan-April 2025 Dust

- The Harmattan winds, originating from the Sahara Desert, will dominate from **mid-January to March**, bringing dry, dusty conditions across the country.
- **Dust Concentration:** High concentrations of particulate matter (PM10 and PM2.5) are expected, significantly reducing visibility to **1-3 kilometers** during peak events.
- **Air Quality Impact:** Moderate to severe air quality deterioration, with AQI (Air Quality Index) likely to reach "Unhealthy" levels in February.

5. Regional Impact

- **Northern Regions:** Higher dust intensity due to proximity to Sahel zones.
- **Coastal Regions:** Slightly lower dust density but still impactful, especially during strong Harmattan surges.

6. Potential Risks

6.1. Agriculture and Food Security

- **Prolonged Dry Spells:** Reduced water availability may affect crop irrigation and livestock health.
- **Pest Infestations:** Increased temperatures may exacerbate outbreaks of pests, impacting crop yields.

6.2. Health Impacts

- **Heat-Related Illnesses:** Higher temperatures increase the risk of heat exhaustion, dehydration, and heatstroke, particularly among vulnerable groups such as children and the elderly.
- **Waterborne Diseases:** Reduced water quality and quantity could lead to outbreaks of cholera and typhoid.

6.3. Water Resources

- **Decreased Availability:** River levels and groundwater reserves are expected to decline, impacting domestic, agricultural, and industrial water use.
- **Urban Areas:** Increased demand may lead to water rationing in Freetown and other major cities.

6.4. Energy Sector

- **Hydropower Challenges:** Reduced river flow could limit hydropower generation, potentially leading to energy shortages.
- **Increased Energy Demand:** Higher temperatures may drive demand for cooling, straining existing power infrastructure.

6.5. Wildfire Risks

- **Bushfires:** Dry vegetation increases the risk of wildfires, particularly in northern region.

7. Recommendations

7.1. For Government and Policymakers

- **Water Resource Management:** Implement rationing and prioritize water supply for critical uses, including agriculture and public health.
- **Heat Action Plans:** Develop localized heat action plans, including early warning systems for heatwaves.
- **Agricultural Support:** Provide drought-resistant seeds, pest management resources, and financial aid to farmers.

7.2. For Communities and Households

- **Water Conservation:** Encourage efficient water use.
- **Health Precautions:** Increase awareness about hydration and heat illness prevention.
- **Fire Safety:** Educate communities on preventing and responding to fires.

7.3. For Key Sectors

- **Health Sector:** Ensure medical facilities are stocked with supplies to treat heat-related illnesses.
- **Energy Sector:** Promote renewable energy solutions like solar to reduce dependency on hydropower.
- **Agriculture:** Encourage early planting and the use of efficient irrigation techniques.

Prepared by:
Sierra Leone Meteorological Agency (SLMet)
January 2025