

INTEGRATED AFRICAN STRATEGY ON METEOROLOGY

(Weather, Water and Climate Services)

Investing in weather and climate services for development
**INTEGRATED AFRICAN STRATEGY
ON METEOROLOGY**
(WEATHER AND CLIMATE SERVICES)



AMCOMET

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Contents

FOREWORD	IV
STATEMENT OF AMCOMET CHAIR	V
PREFACE	VI
EXECUTIVE SUMMARY	1
CONTEXT	3
STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS (SWOT) ANALYSIS OF WEATHER AND CLIMATE SERVICES DELIVERY	5
STAKEHOLDER ANALYSIS	7
PURPOSE AND OBJECTIVE	8
GUIDING PRINCIPLES	8
EXPECTED OUTCOMES	9
STRATEGIC PILLARS	10
SP1: INCREASED POLITICAL SUPPORT AND RECOGNITION OF NMHSS AND RELATED WMO REGIONAL INSTITUTIONS IN AFRICA AT BOTH REGIONAL AND CONTINENTAL LEVELS.	10
SP2: IMPROVED OBSERVATIONAL NETWORKS, DATA ACCESS AND PROCESSING	11
SP3: ENHANCED CAPACITIES FOR THE PRODUCTION AND DELIVERY OF TAILORED WEATHER, WATER, CLIMATE AND CLIMATE CHANGE SERVICES FOR SUSTAINABLE DEVELOPMENT	13
METEOROLOGICAL SERVICES TO THE AVIATION SECTOR	14
METEOROLOGICAL SERVICES TO THE MARINE SECTOR	15
WEATHER, WATER AND CLIMATE SERVICES (INCLUDING EARLY WARNING SYSTEMS)	16
CLIMATE RESILIENCE, CLIMATE CHANGE ADAPTATION AND MITIGATION	16
SP4: RESEARCH, INNOVATION, DEVELOPMENT AND TRAINING	18
SP5: STRENGTHENED PARTNERSHIPS WITH RELEVANT INSTITUTIONS AND THE PRIVATE SECTOR	19
IMPLEMENTATION, RISKS AND ASSUMPTIONS	20
INSTITUTIONAL ARRANGEMENTS	23
TASK FORCES	23
RESOURCE MOBILIZATION	24
MONITORING, EVALUATION AND REPORTING	24
ANNEX: SWOT ANALYSIS	27
LIST OF ACRONYMS	29

Foreword

This updated *Integrated African Strategy on Weather and Climate Services (Meteorology)* provides Africa's strategic direction on the development and application of weather and climate services for the continent's social, economic, and ecological development. The implementation of the strategy makes a critical contribution to the realization of the pan-African vision of *An integrated, prosperous and peaceful Africa, driven by its own citizens, representing a dynamic force in the international arena* as enshrined in Agenda 2063 as well as other regional and global development frameworks such as the Sustainable Development Goals (SDGs), the Paris Agreement on Climate Change, the Sendai Framework for Disaster Risk Reduction, the Global Framework for Climate Services (GFCS), among others.

The strategy is a revised version of the initial one which was endorsed by the Executive Council in January 2013 through Decision EX.CL/Dec.744 (XXII). The process of revising and updating it has offered a unique opportunity to take stock of past achievements and challenges, identify emerging issues, and put forward appropriate measures for the continent's effective realization of its development aspirations.

The five pillars of the strategy demonstrate the Union's commitment to addressing various voices of African people aired through Agenda 2063. As such, the strategy aims to enhance cooperation among African countries and promote coordinated and harmonized action on addressing development challenges related to weather, climate variability and change. It advocates for modernization of National Meteorological and Hydrological Services (NMHSs) as well as enhancement of capacities of NMHSs as key milestones Member States need to attain in order to be able to fully meet their national development needs. By doing so, Member States also contribute to the realization of regional and global development frameworks as highlighted above.

Increased roles of NMHSs at the political level as well as in supporting other development sectors is essential. NMHSs provide essential weather and climate services for policy and decision-making; livelihood security; energy; health; disaster risk reduction; agriculture and food security; security and safety of maritime transport; resilience building; increased safety on land, water and in the air; improved early warning systems; climate risk management for the protection of life, property and the environment; and development planning, among others.

For successful implementation of the strategy, developing and strengthening an enabling environment through human, institutional, financial, and infrastructural capacities is critical. Here, the continent places building and strengthening of mutually beneficial partnerships with relevant stakeholders as crucial for sustainability and capacity building.

This strategy is a product of wide consultative process that involved the African Union (AU) member states, Regional Economic Communities (RECs), the World Meteorological Organization (WMO), Regional Climate Centres, and various relevant stakeholders. I wish, therefore, to thank all those who provided inputs to the document. Let me therefore urge AU member states to implement the strategy and simultaneously request our committed partners to support its implementation in order to translate this framework into a development story that the continent will be proud of.

H.E. Ambassador Josefa Leonel Correia SACKO
Commissioner for Rural Economy and Agriculture
African Union Commission

STATEMENT OF AMCOMET CHAIR

Africa is the most vulnerable continent to climate variability and change, a situation that is aggravated by the interaction of "multiple stresses", including high dependence on rain-fed agriculture and a weak adaptive capacity. Most countries on the continent are prone to floods, droughts, heatwaves, and storms resulting in massive loss and damage.

Besides, water for economic activity, drinking, and livestock is becoming increasingly scarce. Furthermore, COVID-19 has a direct influence and huge economic repercussions on the African continent, especially the developing and least developed countries.

The African Union (AU) Agenda 2063, which was adopted in 2013, recognizes climate change as a major challenge for the continent's development. Since 2015, the intended Nationally Determined Contributions (NDCs) to the Paris Agreement have become the main instrument for guiding policy responses to climate change. Fifty-two (52) African countries have submitted their first NDCs and are now in the process of submitting revised NDCs.

Under a changing climate, the significant increases in temperature, sea level rise, shifts in weather patterns, and other extremes are already having adverse effects on, among others, human health, agriculture, water, natural ecosystems, and other environmental, social and economic impacts. These pose a formidable challenge to Africa's socioeconomic development prospects, which would include among other things, the realization of the United Nations (UN) Sustainable Development Goals (SDGs) and the Sendai Framework on Disaster Risk Reduction (DRR). The unfolding circumstances heighten the need for Member States to design robust approaches that would give direction, coherence, and collective efforts in confronting climate change challenges.

The revision of the Integrated African Strategy on Meteorology (Weather and Climate Services) has been guided by a broad policy, which in a nutshell, embodies the overall expectations in confronting the climate change challenge.

I would like to highlight the paramount role of the National Meteorological and Hydrological Services (NMHSs) in providing essential weather and climate services required for early warning of impending reduce disasters and help build resilient communities through adaptation, and thus contribute to socioeconomic development of Members States on the continent.

This revised Integrated African Strategy on Weather and Climate Services is aimed at laying the foundation for what needs to be done to allow Africa to further benefit from the investments that governments make in meteorology. The guiding principles take cognizance of the multidisciplinary and crosscutting nature of weather, climate and water, both in terms of disciplines and sectors. It also recognizes that most aspects of this strategy will only be realized through partnerships and close collaboration among various sectors, institutions and stakeholders at global, regional and national levels.

I wish to thank the African Union Commission (AUC), the WMO, AMCOMET Bureau Members, and AU member states for their support and input leading to the realization of this Strategy.

I would also like to express my profound gratitude and appreciation to the AMCOMET Secretariat for the work carried out with consistency and courage, bringing essential elements into the process of recognition of the AMCOMET platform as demonstrated in its activities.

I look forward to receiving suggestions on the Way Forward. And let us quote a famous African proverb, "alone we can go fast, but together we can go far"; let us move together.

Pilot Mohamed Manar Anba
Chair of the African Ministerial Conference on Meteorology and Minister of Civil Aviation
Arab Republic of Egypt

PREFACE

This revised Strategy on Meteorology (Weather, Water and Climate) of the African Ministerial Conference on Meteorology (AMCOMET) is a response to the request of the Fourth Ordinary Session of AMCOMET held in Cairo, Egypt in February 2019 for an updated Strategy. The session agreed that the AMCOMET Strategy on Meteorology should be revised to accommodate emerging issues relating to gender equality, data and infrastructure, research, development and innovation as well as public-private engagement.

The existence of large gaps in the meteorological and hydrological observing networks in Africa is a major concern. The number of observing stations in Africa has generally been slowly declining over the last 25 years. Declining observations mean that, in many places in Africa, the quality of forecasts is not improving even though the resolution of numerical weather prediction models has increased significantly in recent years. A particularly serious issue is that the number of critical radiosonde observations – top contributors to the accuracy of numerical weather prediction models – obtained over Africa decreased by as much as 50% between January 2015 and January 2020, (i.e. prior to the COVID-19 pandemic), primarily due to lack of funding. These observations are the foundation for accurate and reliable weather forecasts, early warning of disasters such as droughts, floods, strong winds, sand and dust storms, among others, and as decision support tools in many socioeconomic sectors. It is therefore critical that governments provide more support to their National Meteorological and Hydrological Services for implementing the WMO Global Basic Observing Network (GBON) in Africa in the following years as a high priority, as the data gathered is a national “public good” that enables the production of good forecast and delivery of services that safeguard life, property and economic activities.

Gender equity continues to be at the centre stage in the United Nations (UN) system of governance and WMO remains fully committed to gender equity at the level of the WMO Secretariat, the WMO governing bodies, and WMO Members.

The rapidly changing climate requires that we increase efforts in both climate change mitigation and adaptation. Multi-hazard Early Warning Systems are key components of climate change adaptation and disaster risk reduction strategies and need to be strengthened across the continent. WMO is ready to support this endeavour in the context of its Global Multi-hazard Alert System (GMAS) framework.

WMO is strongly promoting the private-public engagement in Africa in line with the Geneva Declaration-2019 ‘Building community for weather, climate and water actions’. Leveraging resources and innovation with the growing private sector in the region can help to bridge the capacity gap in a mutually beneficial way. To facilitate the public-private engagement, WMO will provide assistance in the development of adequate national legal/institutional frameworks.

I would like to acknowledge the excellent partnership between the African Union Commission (AUC) and WMO, and thank the AMCOMET Bureau for steering the process leading to the validation of this Strategy.

I look forward to the continued strengthening of this partnership for the benefit of Africa and the world.

On behalf of WMO, I assure you of every possible support for the successful implementation of the Strategy.

Prof. Petteri Taalas
Secretary-General, World Meteorological Organization

EXECUTIVE SUMMARY

African National Meteorological and Hydrological Services still suffer from a lack of capacity and resources, both human, technical, technological and financial. Progress has been made to modernize NMHSs, through collaboration with various institutions and development partners. Capacity development and training have been undertaken in some countries to improve technical skills¹ needed to deliver fit for purpose, user-oriented weather, water and climate (hydromet) services.

However, much remains to be done to bring many National Meteorological and Hydrological Services (NMHSs) up to the level that countries will ensure they can meet their national and international mandates and serve their nations and other consumers effectively and sustainably. The current capacity and resources at the national level varies greatly between NMHSs.

Most NMHSs in the region operate with poor infrastructure and limited capability. Their hydromet services are generally poorly developed. Access to global sources of weather and climate data & information (e.g. satellite data, global weather model, global climate data store) is essential to run national weather and climate services and shall be secured for NMHSs to underpin economic growth and sustainable development in the African continent.

The weather, water and climate services provided by NMHSs significantly contribute to the safety and well-being of the African people and communities and support key socioeconomic areas including aviation, agriculture, forestry, fishing, water resources, energy industries, transportation, health and tourism. In addition, these services are crucial to early warning systems for disaster risk reduction and management as well as effectively enhancing resilience to and reducing vulnerability from the effects of climate variability and climate change.

Therefore, The Integrated African Strategy for Meteorology (Weather and Climate Services) has been developed to enhance the cooperation between African countries and to ensure that NMHSs are modernized and have the capacity to fulfil their responsibilities including in the implementation of the National Global Framework for Weather Water and Climate Services (NFWWCS).² The strategy seeks also to ensure that 'No country is left behind' and countries contribute to their national development plans, and to the regional and global development agendas and framework (AU Agenda 2063: 'The Africa We Want',³ the Paris Agreement on Climate Change,⁴ the Sendai Framework for Disaster Risk Reduction⁵ and the United Nations SDGs⁶)

¹ Technical skills for climate services include collection of: archiving, quality control and management of historical climate data sets, analysing and deriving products from climate data, interpreting model outputs and generating climate prediction across timescales from sub-seasonal to climate change projections, ensuring the quality of climate information and services, and communication of climatological information to users.

² In addition to the NMHSs themselves, other African stakeholders, including the private sector, the academia, research institutions and civil society organizations, should also be consulted and involved. International stakeholders, as partners, are invited to participate in the implementation of the Strategy and align their support with the Strategic Pillars and identified needs of key stakeholders.

³ <https://au.int/en/agenda2063>.

⁴ <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.

⁵ <https://www.unisdr.org/we/coordinate/sendai-framework>.

⁶ <https://sustainabledevelopment.un.org/?menu=1300>.

The Strategy of AMCOMET comprises five strategic embedded pillars (SPs):

SP1: Increased political support and recognition of NMHSs

SP2: Improved observational networks, data access and processing

SP3: Enhanced capacities for the production and delivery of tailored weather, water, climate and climate change services for sustainable development

SP4: Research, Innovation, Development and Training

SP5: Strengthened partnerships with relevant institutions and the private sector

The Strategy sets out priority actions that can be undertaken at national, subregional regional and continental levels in partnership with development partners, the private sector and academia in a coordinated, integrated and sustained manner that will benefit the continent.

CONTEXT

The African Ministers and Heads of Delegation participating in the Ministerial Segment of the First Conference of Ministers Responsible for Meteorology in Africa which was held in Nairobi, Kenya on 15 and 16 April 2010, agreed, through the Nairobi Ministerial Declaration⁷, to establish the African Ministerial Conference on Meteorology (AMCOMET) as a high-level mechanism for the development of meteorology and its applications in Africa. The African ministers recognized that weather and climate services are an integral part of the socioeconomic development of every country, and therefore deserve strong support at the highest possible level of government. Ministers further recognized that sound governance of the science of meteorology and its related applications must be streamlined in national development agendas to promote cooperation, security, socioeconomic development and poverty reduction at a pan-African level. By establishing AMCOMET, the ministers committed themselves to carrying out the following:

Strengthen and sustain National Meteorological and Hydrological Services (NMHSs) by providing the resources and appropriate institutional and legal frameworks to enable them to execute their functions, particularly in data observations, data sharing, forecasting, services delivery and applications;

Recognize the role of meteorological services as a fundamental component of national development infrastructure, and ensure that meteorological information is an essential and permanent parameter and feature in national developmental plans, programmes and policies in the key sectors of a country's economy;

Recognize NMHSs as strategic national assets that contribute to sustainable development, particularly poverty reduction efforts (especially with regards to tailored services to agriculture, water, energy, health, and transport among others), in addition to being vital to national security and safety (through resilience building of society, economy, ecosystems, and the environment against adverse impacts of climate change using mitigation and adaptation options as well as disaster risk reduction (DRR) mechanism of early warning);

Ensure that all subregions of the African continent are active and adequately resourced.

Furthermore, the ministers agreed to develop an "African Strategy on Meteorology". This has been carried out in partnership with WMO and the African Union Commission (AUC), which were engaged in the preparation of the Strategy through consultation with Regional Economic Communities (RECs), Member States, Regional Climate Centres (RCCs) and other relevant stakeholders at the global, pan-African, subcontinental and national levels.

Statistics indicate that Hydrometeorological hazards are responsible for 90% of total disaster losses worldwide.⁸ Their effects are projected to become even more severe due to population growth, rapid urbanization and climate change. Hydromet services are therefore essential to provide real-time weather, water, early warning and climate information and services to end users, based on scientifically processed data.

Over the last few decades, countries in Africa have made significant development achievements attaining an average annual gross domestic product of 4.5%. However,

7

https://www.wmo.int/amcomet/sites/default/files/field/doc/events/declaration_amconf_en_06122010.pdf.

⁸ <https://www.worldbank.org/en/results/2017/12/01/hydromet>.

the increasing weather, water and climate risks continue to pose a significant threat to these gains. The continent has experienced more than 2 000 natural disasters since 1970, with just under half taking place in the last decade and natural disasters that have affected over 460 million people and resulted in more than 880 000 casualties. In addition, it is estimated that by 2030, up to 118 million extremely poor people (living below US\$ 1.25/day) will be exposed to drought, floods, and extreme heat in Africa. In areas of recurrent disasters, this hampers growth and makes it harder for the poor to escape poverty.⁹

Less than 20% of sub-Saharan African countries provide reliable weather, water and climate services to their people and economies¹⁰. As a result of the enormous societal needs, governments often juggle competing priorities for investment and funding and the generally poor understanding of the important role which NMHSs play, they are seldom prioritized by governments. The consequent underfunding of these services unfortunately inhibits NMHSs from providing the much-needed services for climate-resilient development and adaptation planning.

There is an increasing need for the delivery of sector-specific weather, water and climate services to ensure food security, improved water resource management, DRR and better health. To enable provision of these services at the national level, efforts need to be made to modernize NMHSs, from strengthening institutions through improving the observation network to service delivery. Subregional efforts include standardizing procedures to promote transboundary collaboration. Africa-wide efforts ensure hydromet services across the continent will be linked to regional and global centres, thus improving data access and availability, and promoting partnerships within the meteorological community.

Moreover, the science and technology related to weather forecasting and climate services are rapidly advancing globally (for example, new generations of weather satellites, cloud computing, big data and high-performance computing). Some countries in Africa might not be able to cope with these rapidly changing technologies due to lack of capacity and access to the necessary knowledge and tools. Many NMHSs have a stagnant pool of human and financial resources and obsolete technologies that limit their capabilities to produce the best services needed by policymakers and other decision makers. There is therefore the need for adequate human capacity, technological and infrastructural development in both short- and long-terms through institutional support to provide accurate and reliable forecasts.

Accurate and timely weather forecasts and climate analyses and predictions will improve human safety, prosperity and livelihood, and preserve precious natural resources for the benefit of communities, especially the most vulnerable. This is the rationale for the creation of AMCOMET, which aims to provide political leadership, policy direction and advocacy in the provision of weather, water and climate information and services that meet societal and sector-specific needs, including in agriculture, health, water resource management, energy and disaster risk reduction. AMCOMET's key objective is to promote security, socioeconomic development and poverty reduction on a pan-African level through sound governance of the science of meteorology and its related applications.

At the pan-African and multi-stakeholder levels, institutions exist that can support the objectives of AMCOMET. The building blocks of AUC are RECs, which facilitate subregional development and implementation of AUC-supported programmes and mechanisms. As AMCOMET brings political support, it is critical to establish cooperation

⁹ World Bank, Global Facility for Disaster Reduction and Recovery (GFDRR) – 2016 – [Striving Toward Disaster Resilient Development in Sub-Saharan Africa Strategic Framework 2016–2020](#)

¹⁰ <https://www.worldbank.org/en/results/2017/12/01/hydromet>

with RECs, and ensure that they are part of the AMCOMET process to harmonize development of meteorology through regional approaches and minimize duplication of efforts among NMHSs. It is also necessary to imbed the Strategy within REC operations to promote interregional cooperation for socioeconomic development within the context of weather and climate services.

The investment and financial flows needed to support the delivery of weather and climate services to address the challenges of climate variability and change in Africa are substantial. In addition to national governments' investments in NMHSs and the critical role that national institutions play in ensuring investments are sustainable, it is acknowledged that the African Development Bank (AfDB), as the premier financial institution, plays a key role (through the Climate for Development in Africa (ClimDev-Africa) programme, for example) in providing the complementary financial support for the implementation of the Strategy. However, the Strategy demands large investments for modernization of African NMHSs hence requires partners such as the Green Climate Fund, the UNDP, the World Bank and other bilateral and multilateral development partners to cooperate and coordinate efforts for the efficient and effective implementation of the Strategy. AMCOMET is the natural platform for such coordination among such development partners. Additionally, the African Union has established several partnerships which can be exploited to support the delivery of weather and climate services to address the challenges of climate variability and change in the continent.

This Strategy recognizes that sustainability of future projects will rely upon integrated support for equipment, maintenance, operation, service development and training elements. With recent technological developments, cooperation with global centres through WMO will facilitate low-cost processing and storage of relevant large datasets, thus reducing the equipment and maintenance costs required in developing countries. Service development budgets are becoming essential given the emerging sectors requiring weather and climate services.

STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS (SWOT) ANALYSIS OF WEATHER AND CLIMATE SERVICES DELIVERY

A SWOT analysis of weather and climate services delivered by African NMHSs was conducted from June to September 2018. It was based on a previous SWOT analysis which was carried out in 2010 and was the result of collective work conducted by a WMO consultant working with several stakeholders. Details of the SWOT analysis are presented in the [annex](#).

The conclusions of the **SWOT** analysis are as follows:

- There is limited visibility and national funding for modernization processes, although NMHSs are recognized as national strategic partners in weather, water and climate services, especially for DRR for safety and security of lives, protection of property and the environment;
- Limited legislation for establishing semi-autonomous/autonomous NMHSs;
- Limited "cost recovery" mechanisms especially for services other than aviation;
- NMHSs provide key weather, climate and water information for the necessary socioeconomic development at the national level in many sectors but this is not always easy to demonstrate and communicate;
- Existing observation networks need to be upgraded and modernized;

- Access to global weather and climate data (for example: satellite data, climate data and global Numerical Weather Prediction (NWP) – model data), which are key for national weather and climate services, is not secured;
- Limited human capacities: there is a clear need to enhance NMHS human capacities, in both technical and managerial areas, although training has been delivered through regional and international cooperation, including by existing WMO RTCs;
- The Regional Framework for Climate Services (RFCS) and the National Framework for Climate Services (NFCS) of GFCS in most of Africa are not yet functional;
- WMO Integrated Global Observing Systems (WIGOS)/WMO Information Systems (WIS), including nomination of focal points of these programmes, are to be put in place;
- Raising awareness of gender aspects in terms of service provision and organizational performance at national, regional and continental levels is a key opportunity to modernize. It requires creating inclusive institutions and providing better tailored products and services to be responsive to the needs of women who play a pivotal role for their families and communities, particularly in the rural setting;
- New technologies create opportunities for African NMHS development (for example, through information technology systems, satellite technology and mobile applications); establishing broadband Internet connectivity will help the modernization process;
- Increased collaboration in some countries with national media (especially on disasters and hazards faced by communities) has helped to raise public awareness;
- There is a lack of strategic planning competencies and processes, including human resource planning, marketing and communication, monitoring and evaluation, Total Quality Management (TQM), strategic indicators follow-up and so forth;
- There is a limited alignment among NMHS strategic plans (if they exist), governmental national development plans, regional and global agenda as well as with donor funded programmes and projects;
- Thirty-four least developed countries have urgent needs for support and development in many areas (such as technical, human and financial) due to obsolete infrastructure and extremely low capacity to produce and deliver services;
- A clear opportunity for NMHSs in Africa is the increasing need for collaboration with the private sector;
- There is a need to strengthen coordination and improve knowledge at the national level, among NMHSs, other national institutions, academia and the private sector;
- Lack of coordination in investments funded by donor. Donors come with projects which may not be the priority of the countries. Aligning the project with the AMCOMET strategy with the country priority may help achieving tangible results;
- The use of Quality Management Systems (QMSs) could enhance NMHS core and specific competencies.

STAKEHOLDER ANALYSIS

The stakeholder analysis identified the key partners essential in the implementation of Strategy activities at the global, pan-African, subcontinental and national levels.

Partners have important roles at the level of formulation of appropriate policies relevant to the goals and aspirations of African Union and WMO Members. Partners are also critical at the level of facilitating the delivery of weather, climate and water-related information and services. These partners include: regional bodies; subregional economic communities; research, training and policy-related institutions; disaster managers and civil protection agencies; non-governmental organizations including civil society organization (CSO), community based organizations (CBO), among others; academia; media and communications organizations; parliamentarians; African climate negotiators, and United Nations agencies operating in the Africa region.

Development partners including the private sector and banks are also important given that resource mobilization for implementing the Strategy is a key requirement in the implementation plan.

The key issues for supporting the implementation of the Strategy generally revolve around the following:

- Cooperating with national and international stakeholders to enable adequate delivery of weather, climate and water-related information and services in the region
- Developing institutional and human resources in NMHSs
- Developing strategic and action plans articulating vision, priorities, long-term goals, objectives, activities and funding requirements, as well as contributions of the activities to be implemented for national socioeconomic development
- Committing NMHSs to collaborate closely to address common challenges, particularly in the area of hydromet-related DRR
- Engaging relevant stakeholders, especially policymakers, in investing in the multifarious infrastructure necessary to provide accurate and timely weather, water and climate services that meet the needs of end users
- Addressing the issues surrounding risk management, early warning, climate change and climate variability, with emphasis on investing in the necessary resources to adequately disseminate weather and climate services for informed decision-making.

There are important and critical players that must work together for weather and climate services in Africa to be effective. Appropriate forums are therefore essential to continuously engage and carefully manage the different types of stakeholders, in order to sustain these important relations and cooperation.

PURPOSE AND OBJECTIVE

The overall purpose of the Strategy is to position weather, water and climate services as an essential component in the national and regional development framework and for sustainable development in Africa, particularly in poverty reduction efforts, climate change adaptation and disaster risk reduction.

The objective of the Strategy is to enhance cooperation among African countries and to strengthen capabilities of governments to provide weather, climate and hydrological services, in which NMHSs play a critical role. At the same time, the Strategy is a blueprint for linkages of African NMHS actions with the Africa Agenda 2063: 'The Africa We Want',¹¹ the Paris Agreement on Climate Change,¹² the Sendai Framework for Disaster Risk Reduction¹³ and the United Nations SDGs.¹⁴

The Strategy further aims to serve as a framework for integrated and coordinated mechanisms that provide strategic direction to Members and other stakeholders in streamlining policies that address challenges and opportunities associated with the development of adequate weather, water and climate services at national, regional and continental levels.

Guiding principles

The Strategy should:

- Be collectively owned by Africa;
- Be programme-oriented as per identified regional and continental priorities;
- Be focused on actionable policies with measurable outcomes and positive impacts on national economies, and address societal and sectoral needs and challenges at all African levels, including the community level;
- Concentrate on benefiting Africa while contributing to global efforts in the advancement of the science of meteorology;
- Be implemented to promote regional integration and cooperation.

¹¹ <https://au.int/en/agenda2063>.

¹² <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.

¹³ <https://www.unisdr.org/we/coordinate/sendai-framework>.

¹⁴ <https://sustainabledevelopment.un.org/?menu=1300>.

EXPECTED OUTCOMES

The intended outcomes of the Strategy are as follows:

Improved NMHSs and harmonization of regional and national Strategy where in existence, through development of National Strategies and Action Plans by AU members;

Increased recognition of NMHSs' roles at the political level together with strong legal and institutional frameworks as well as financial support. It is vital for Africa's governments and policymakers to take on board the contribution of NMHSs to socioeconomic planning and development, integrate them in national development programmes and accord the necessary financial support;

Recognition of NMHSs as providers of essential services for: disaster risk reduction in floods, droughts, gusty winds, thunderstorms and lightning; services for food security (sub-seasonal to seasonal prediction – RCOFs- and climate prediction); security and safety of air navigation and maritime transport; as well as data providers for resilience building against adverse impacts of climate change;

Accelerated implementation of the African Union Strategy for **Gender Equality** and Women's Empowerment (2018–2028)¹⁵, the WMO Gender Policy and Action Plan¹⁶, the African Union Gender Policy¹⁷, the [African Youth Charter](#)¹⁸, the AU Youth Engagement Strategy¹⁹, and other Youth related policies at all African levels through the active role of Regional Associations;

Improved Early Warning Systems and climate risk management for the protection of life, property and the environment. Increased and timely availability of hydromet information (including warnings and forecasts) leads to reduced loss of life, safer infrastructure and reduced vulnerability of society;

Increased safety on land, on water and in the air. Improved use of sector-specific meteorological products and services such as forecasts for road and rail transportation, sea and lake navigation, coastal trading, fishing, recreational boating and aviation leads to reduced associated risks;

Enhanced quality of life. Communities and institutions are better informed and educated on the societal values of hydromet information, which leads to sustained socioeconomic growth, including reduced health problems, improved food security, reduced disaster and climate risk, and better quality of life. Their ability to act accordingly is also important;

Enhanced cooperation among African countries to strengthen NMHSs in developing coordinated research and operational capabilities, in addressing transboundary weather and climate impacts and in contributing to national, regional and global networks and initiatives in the context of DRR and climate change;

Improved NMHS sustainability and service orientation through effective implementation of the emerging Public-Private Engagement (PPE) and financing for a mutually beneficial relationship in the Public-Private Partnership (PPP) between NMHSs in Africa and private sector firms as well as NMHSs from the developed countries under the paradigm shift of the **Global Weather Enterprise (GWE)**.

¹⁵ https://au.int/sites/default/files/documents/36195-doc-au_strategy_for_gender_equality_womens_empowerment_2018-2028_report.pdf

¹⁶ https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/GAP_Draft.pdf?VDGolo0GoiMq9aT5FAHzO2uHJdKJTqmZ.

¹⁷ http://www.un.org/en/africa/osaa/pdf/au/gender_policy_2009.pdf.

¹⁸ <https://au.int/en/treaties/african-youth-charter>

¹⁹ https://au.int/sites/default/files/documents/38528-doc-aga-yes_web_english-2.pdf

STRATEGIC PILLARS

The Strategy is a collective endeavour designed to contribute to and address hydromet-related challenges faced by African countries. It therefore identifies and harnesses existing opportunities. It focuses on five Strategic Pillar SPs that highlight feasible and actionable policies with measurable outcomes and positive impacts on national socioeconomic development.

SP1: Increased political support and recognition of NMHSs and related WMO Regional Institutions in Africa at both regional and continental levels.

In many African countries, the ministers responsible for meteorology have key roles in raising the profiles and relevance of NMHSs. This is now more critical due to the rapid increase of extreme weather events which are impacting on the socioeconomic development of national economies. Added to this is the entry of the private sector and other national institutions into the domain traditionally core to NMHSs, especially weather forecasting and early warning of disasters. This has brought about competition between them and the NMHSs thereby confusing the end-user and decision makers. In order to ensure that NMHSs remain the first port of call for warnings of disasters in any country, they need legal protection. AMCOMET is therefore called upon to facilitate the process leading to the transformation of NMHSs into legalized entities that will be either autonomous or semi-autonomous agencies. This transformation will enable them to embark on cost recovery and generate revenue that will go along towards survival and sustainability.

This pillar aims to increase recognition of the role of NMHSs within the political decision-making arena through the integration of hydro-meteorological service contributions to various economic sectors and in national development policies, strategies and programmes. The SP1 further aims to increase sustainability of services with the active participation of relevant intergovernmental officials and other stakeholders including the emerging private sector in establishing adequate weather and climate services, at the national and regional levels, aligned with policies that address development challenges and opportunities.

The areas of action are to:

- Formulate policies and provide the necessary legislation to ensure that NMHSs acquire more autonomy in the longer term, so they are adequately financed to fulfil their mandates and able to embark on, and benefit from, cost recovery. With the implementation of National strategic Plans (NSP) for NMHSs and NFCS embodying more players, mechanisms should be put in place to recover costs of services in a similar way as those for aviation;
- Ensure that the legislation designate NMHSs as the leading authorities on climate change science-based projections and the Intergovernmental Panel on Climate Change (IPCC) matters. This will ensure country climate-sensitive sectors do not use climate change scenarios from different sources with different projects and so create confusion;
- Promote twinning programmes in development of policy and legal frameworks to benefit from Members /NMHSs who have already developed meteorological legislations;
- Ensure that NMHSs develop strategic and business plans, service charters aligned with their governments' development agenda and priorities, as well as linked to regional agenda (AU Agenda 2063: "The Africa we want" and global Transformation Agenda (2030 UN SDGs and the Sendai Framework on DRR);

- Ensure that RCCs develop strategic and business plans aligned with AUC and REC agenda and priorities;
- Facilitate regular meetings with policymakers to inform them of NMHS/RCC activities and plans as well as to demonstrate the value of weather and climate services and their relevance to socioeconomic development;
- Establish when not existing and develop national frameworks and platforms (e.g. Climate Change National Platforms) that facilitate coordination of activities with the involvement of all stakeholders, and eventually organize direct interactions/awareness training with and for them (including parliamentarians, community leaders, ministries of finance and planning, and so forth);
- Ensure regular uptake and utilization of RCC products and services by NMHSs, as well as collection of feedback using Regional Climate Outlook Forums and National Climate Outlook Forums (NCOFSs), to help refine RCC products and services;
- Facilitate close cooperation from RECs and other relevant African institutions to support production and delivery of weather, water and climate services value chain;
- Accelerate implementation of the African Union Gender Policy and the WMO Gender Action Plan at national, regional and continental levels through the active role of Regional Associations;
- Develop specific programmes and workshops to implement operationally the African Union Gender Policy²⁰ and the WMO Gender Action Plan²¹ at the continental, regional and national levels;
- Develop specific programmes and workshops for the youth, the minorities and the vulnerable groups;
- Ensure that the necessary funding is provided to sustain and develop NMHSs and RCCs through appropriate national and regional mechanisms, including their possible transition into semi-autonomous or autonomous entities, where and when appropriate;
- Ensure that all subregions of Africa are equitably considered, including the establishment of RCCs and Regional Specialized Meteorological Centres (RSMCs) across the continent such as a subregional climate institution for sustainable development in Central Africa.

SP2: Improved observational networks, data access and processing

The observational network in most African countries is scarce and obsolete. Weather stations are so far apart that their data cannot be extrapolated to the local level due to the varying terrain and altitude. In addition, there has to be continuous monitoring and appropriate forecasting of severe weather and extreme climate events. Africa is utilizing NWP and satellite-derived products provided from outside the continent, with limited involvement in the design of these products. In addition to being a consumer of these products, the continent should develop its own expertise to generate Africa-tailored satellite-based products and NWP model outputs.

²⁰ http://www.un.org/en/africa/osaa/pdf/au/gender_policy_2009.pdf.

²¹ https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/GAP_Draft.pdf?VDGolo0GoiMq9aT5FAHzO2uHJdKJTqmZ.

Many countries have now embarked on automation of their NMHSs. These include installation of automatic weather stations. While this is noble in principle, these installations have not been properly coordinated as they have involved many vendors resulting in compatibility, traceability and interoperability problems. In addition, many sensors are not ISO certified and the vendors are not internationally recognized. As a result, the data do not meet WMO standards nor can it be incorporated into the Global Telecommunications System (GTS). There is need for this problem to be regularized as good quality and reliable data is the basis for quality and accurate weather and climate forecasts and attendant applications.

In addition to ground-based observations, there is need to enhance and harness remotely sensed data. Meteorological radar and satellite products are increasingly becoming more critical as they cover areas where there no hydro-meteorological stations. The products for now casting and monitoring of extreme precipitation. Regrettably, there are very few operational radars in Africa, and these are not networked to produce regional mosaics. While they may be deemed expensive to purchase, they are long-term worthy investments in terms of protection of lives, infrastructure, and property. Satellites provide even more coverage and they offer a wide range of products for applications. These include, among others, weather forecasting, tracking evolution, development and of tropical cyclones and severe storms, monitoring of forest fires and vegetation, and mapping of flooded areas. In this regard, the African Space Strategy should be implemented as a matter of urgency and seize the opportunities from the ongoing partnerships between the African Union, the European Union, China and Japan.

The areas of action are to:

- Develop and sustain an observation network that is fit for purpose, with a design that cascades down from the needs of users, and invest in the relevant weather and climate monitoring infrastructure (data observation networks) such as automatic weather stations, meteorological radars, and rain and water gauges, which satisfies the Global Basic Observing Network (GBON) and the Regional Basic Observing Network (RBON) as well as connecting to the WIS;
- Ensure that NMHS implement WMO Integrated Global Observing System (WIGOS) programme and WIGOS Regional centres are operational;
- Develop the relevant business models for generating and accessing data and for enhancing observations. Collectively engage manufacturers of meteorological equipment, accessories, and consumables towards the lowering of costs, rendering the equipment more affordable in an effort to improve station density and sustainability, and provide the training necessary for installing and maintaining networks;
- Enhance telecommunications systems within and among the countries, including through the regional and global Data Collection and Production Centres (DCPC) of WIS;
- Ensure sustainable access and use of existing and future geostationary (and polar-orbiting weather satellites), in particular the Meteosat Third Generation (MTG), which will be located above the Gulf of Guinea and provide weather observations over the whole African continent every 10 minutes;
- Ensure that the African meteorological weather requirements on satellite-derived products are channelled through the regional WIGOS and the WMO Space Programme, in addition to the Regional African Satellite Communication Organization (RASCOC) existing telecommunications satellite, as well as AU program related to its space policy;

- Facilitate access and use of globally available operational oceanography data from oceanography satellite operators (for example, Jason or Sentinel-3) and global ocean analysis and forecast centres (for example, the Copernicus Marine service) as well as the production of African-tailored marine forecast products based on these global data;
- Facilitate the deployment of buoys, where necessary, particularly in the Indian Ocean, and other critical areas (Atlantic and inland waterways such as Lake Victoria);
- Facilitate the sustained provision of global and regional coverage of observational data, products and services to address the continued and expanding requirements of the maritime user community for met-ocean information and services, including development of tsunami capabilities and monitoring of tropical cyclones;
- Ensure that all NMHSs align with WMO standards and put in place a QMS.

SP3: Enhanced capacities for the production and delivery of tailored weather, water, climate and climate change services for sustainable development

Acknowledging the complexity of the landscape of service delivery, and also the critical role of NMHSs as the main providers of the expanding portfolio of hydromet services in Africa, this pillar aims to improve the effectiveness and efficiency of the production and delivery of services enabling appropriate responses to the changing needs of government, society and sectoral users through suitable structures and working mechanisms. Co-design, co-development and co-production, at African and international levels, are to be embedded in this SP, as key elements to enhance capacities in producing and delivering the tailored services.

One of the fundamental elements to achieving this is to fill the weather and climate data observation gaps as well as to facilitate data and product exchange among relevant institutions. Furthermore, there is an urgent need to strengthen NMHS scientific and technological capacities to improve the delivery of tailored products and services to all communities including the aviation and marine sectors, as well as the new highly demanding sectors of agriculture, water resources, health, disaster risk reduction and management and energy through the implementation of National Framework of Weather, Water and Climate Services (NFWWCS). Climate change mitigation and adaptation is another area where weather, water and climate information ranging from timescales of hours to decades (10 years) can play a significant role in early warnings systems as well as in adaptive planning policies and contribute to the achievements of the AU Agenda 2063 and SDGs, Sendai Framework.

Implementation of this SP should be aligned with WMO programmes such as the Space Programme,²² the Global Data-Processing and Forecasting Systems (GDPFS),²³ the Climate Services Information Service (CSIS),²⁴ GFCS,²⁵ the World Climate Services Programme,²⁶ the Commission for Climatology,²⁷ the World Weather Research

²² http://extranet.wmo.int/pages/prog/sat/index_en.php.

²³ <http://www.wmo.int/pages/prog/www/DPS/gdps.html>.

²⁴ <https://www.wmo.int/gfcs/CSIS>.

²⁵ <http://www.wmo.int/gfcs/>.

²⁶ <http://www.wmo.int/pages/prog/wcp/wcsp.html>.

²⁷ http://www.wmo.int/pages/prog/wcp/ccl/index_en.php.

Programme (WWRP)²⁸, the World Climate Research Programme (WCRP)²⁹, the aeronautical and marine meteorology programme, the African Space Policy³⁰ and Strategy³¹ and the Abidjan Declaration³² should also be taken into account.

Meteorological Services to the Aviation sector

The International Civil Aviation Organization (ICAO) requires that meteorological authorities should supply operators, flight crew members, air traffic service units, search and rescue service units, airport management and other related aviation stakeholders with meteorological information that meets the needs of international air navigation.³³ AMCOMET is urgently required to facilitate the availing of national funds to ensure that the countries meet ICAO deadlines³⁴ in terms of compliance and aviation requirements.

The areas of action for aviation are to:

- Develop and implement a QMS for meteorological services for international air navigation conforming to the requirements of ICAO, including certification to the ISO 9000 series of quality management standards;
- Facilitate QMS training to staff from various NMHSs and use them as consultants to put in place QMSs in other NMHSs in Africa under twinning programme;
- Ensure that the competency of aeronautical meteorological personnel (observers and forecasters) meets international standards established by WMO;
- Ensure regular maintenance and calibration of equipment in line with WMO standards;
- Ensure optimal use of existing products supplied by regional and global centres (for example, world area forecast centres and volcanic ash advisory centres) to ensure national/subregional service provision;
- Facilitate access, use and development of satellite-based meteorological products for aviation (for example, lightning detection, tropopause folding turbulences, fog detection and volcanic ash).

²⁸ <https://public.wmo.int/en/programmes/world-weather-research-programme>.

²⁹ <https://public.wmo.int/en/programmes/world-climate-research-programme>.

³⁰ https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-african_space_policy_-_st20444_e_original.pdf.

³¹ https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-african_space_strategy_-_st20445_e_original.pdf.

³² https://www.wmo.int/amcomet/sites/default/files/field/doc/events/abidjan_declaration_-_signed_by_all.pdf.

³³ https://www.wmo.int/amcomet/sites/default/files/field/doc/events/annex_4_safe_skies.pdf.

³⁴ NMHSs to be certified to International Organization for Standardization (ISO) standard ISO 9001, equipment with calibration certificates and readings to be regularly verified, skills of personnel to be regularly updated and controlled, and so forth.

Meteorological Services to the Marine sector

Meteorological forecasts and warnings that are critical for safety of life and property at sea, integrated coastal management and societal impacts should be provided by NMHSs. The standard and recommended practices for marine meteorological services in coastal waters, ports and lakes are described in the *WMO Manual on Marine Meteorological Services* (WMO-No. 558).³⁵ The user requirements for marine services and guidance for improved service delivery are described in the *WMO Guide to Marine Meteorological Services* (WMO-No. 471).³⁶

For national shipping, the United Nations Convention on Safety of Life at Sea outlines the communication infrastructure that contracting governments should provide as part of the Global Maritime Distress and Safety System (GMDSS). NMHSs should make arrangements to provide marine forecasts and warnings to mariners at sea in their national waters on the available GMDSS infrastructure. For international shipping, there is a coordinated forecast and warning service, and broadcasts to ships through the International Maritime Organization/WMO Worldwide Met-Ocean Information and Warning Service.

The Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) provides the technical expertise to support NMHS marine service delivery.

The areas of action for marine are to:

- Ensure that NMHSs fully utilize the available marine-related model guidance products available from GDPFS RSMCs;
- Establish verification mechanisms to monitor performance and communicate with stakeholders;
- Improve communication among Members and JCOMM expert teams, through nomination of a National Marine Services Focal Point for each Member;
- Implement the standard and recommended practices for forecast and warning services covering coastal waters, ports and lakes, as described in the *Manual on Marine Meteorological Services* (WMO-No. 558);
- Improve mechanisms and regional coordination to train and assess marine forecasters against the WMO Marine Forecaster Competency Framework;
- Develop relevant education content on marine hazards, and on how to fully utilize the forecast and warning services available from NMHSs for daily planning and decision-making;
- Foster and develop relationships with relevant government agencies and marine safety organizations to improve connection with decision makers and emergency response operations;
- Facilitate the establishment of cost recovery for marine services.

³⁵ https://library.wmo.int/index.php?lvl=notice_display&id=9784#.YEHoNmhKiUk

³⁶ https://library.wmo.int/index.php?lvl=notice_display&id=7469#.YEDyIWWhKiUk

Weather, Water and Climate services (including Early Warning Systems)

Following the World Climate Conference-3 (WCC-3)³⁷ and the establishment of the Global Framework for Climate Services (GFCS), there was a strong recommendation to cascade at regional and national levels. The objective of the framework is to strengthen the resilience of the societies against climate change and variability. The priority areas are agriculture and food security, water resources, disaster risk reduction, health and energy. Therefore, it is important to establish National Framework for Weather, Water and Climate Services (NFWCS) which has replaced the NFCS and implement it effectively with NMHSs playing the key role in delivering the services in partnership and collaboration with national stakeholders. It is worth noting that Climate Services include weather, water and climate services, and to avoid confusing with partners, the term weather, water and climate services are now being explicitly used.

The areas of action are to:

- Facilitate establishment of NFWCS.
- Ensure sufficient funds are mobilized at national level for a full implementation.
- Enable the human capacity development necessary for climate research, modelling, and prediction, and for generation of tailored climate information and services.
- Implement CSIS and the Climate User Interface Platform (CUIP)³⁸ at all African levels.
- Develop an action statement on user engagement, co-production, intermediaries to provide contact with the community and so forth, and thus encourage the uptake of hydromet services by co-developing products with users.
- Create and sustain national and regional forums that facilitate and encourage continuous interaction among meteorological experts, national meteorological advisers, sectoral stakeholders, and government policymakers at the appropriate governmental levels.
- Improve service delivery mechanisms, particularly early warning systems (EWS), climate watch advisories and awareness systems.
- Improve channels of communication to enable prompt and informed decision-making, taking into consideration the highly perishable nature of most weather products such as forecasts, warnings, and advisories. Communication of this important information should also ensure that the products and services reach the most vulnerable and in remote areas, to avoid or reduce calamities.

Climate resilience, climate change adaptation and mitigation

Africa is one of the most vulnerable regions of the world to the impacts of climate change. Most of the continent's disasters are meteorological and hydrological related. These disasters pose a serious threat to the continent's ability to attain the Sustainable Development Goals³⁹. While impacts vary across the continent, it is generally agreed

³⁷ https://gfcs.wmo.int/wwc_3

³⁸ <https://www.wmo.int/gfcs/UIP>

³⁹ See linkages between Agenda 2063 "The Africa We Want – The critical factors for success" and

that the climate is becoming more extreme, and as such, the overall future of the African continent is bleak unless adequate preparations are made and sufficient mitigation as well as risk reduction measures are put in place.

It is crucial that AMCOMET, in collaboration with relevant African Ministerial Conference on Environment (AMCEN), be actively involved in climate negotiations. Accordingly, AMCOMET should partner with other AU specialized technical organs such as the AMCEN, the African Ministers Conference on Water (AMCOW), ministerial Specialized Technical Committee (STC) in charge of Space and Science and Technology, DRR and the Conference / Committee of African Heads of States and Government on Climate Change (CAHOSCC).

The areas of action are to:

- Ensure that NMHSs actively involved and engaged in the preparation of National Determined Contributions (NDCs) and can access climate funds that help them develop products for climate resilience and adaptation;
- Ensure that NMHSs are involved in the design of the relevant national adaptation programme of actions plans⁴⁰(NAPA) and natural disaster vulnerability mapping, in alignment with the national DRR management plan;
- Involve and engage the African Continental Free Trade Area (ACFTA) - as weather and climate information are important for the socioeconomic development of Africa particularly for Water, Agriculture, Health, Energy;
- Involve and engage the Ministries of Finance, Planning and Economic Development, and Foreign Affairs as well as the funding institutions and a broader range of stakeholders including Civil Societies to ensure sufficient government funding for NMHSs as well as external development Funds;
- Liaise with relevant continental institutions and platforms⁴¹ such as the African Group of Negotiators (AGN) and AMCEN to develop a new African agenda and position on climate change. This will enable Africa to articulate its position at the international level such as under the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Group of 77 and China, the AGN and the IPCC;
- Ensure that AMCOMET and NMHSs actively participate in international negotiations such as those of the Conference of the Parties (COPs) to the UNFCCC, the United Nations Convention on Biological Diversity, the United Nations Convention to Combat Desertification (UNCCD) and the IPCC;
- Ensure the development and implementation of a structured RFCS at the African level, in line with the recommendation of the African Union Specialized Technical Committee on Agriculture, Rural Development, Water and Environment (AU STC ARDWE) as adopted by the African Union Executive Council in January 2018⁴²

the Sustainable Development Goals at <http://www.un.org/en/africa/osaa/pdf/events/20160420/linkagesagenda2063sdg.pdf> and www.un.org/en/africa/osaa/pdf/au/agenda2063-framework.pdf

⁴⁰ www.africaadaptationinitiative.org/.

⁴¹ Such as CAHOSCC, African Group of Negotiators and African Union organs.

⁴² https://au.int/sites/default/files/decisions/33909-ex_cl_decisions_986-1007_e.pdf.

SP4: Research, Innovation, Development and Training

The research output of many countries is significantly affected by the amount of funds dedicated to research, innovation and development. Research has shown that there is a strong correlation between the level of research excellence a country attains and the amount of fund it dedicates to research, innovation and development. The 'critical mass' of overall Research and Development (R&D) expenditure needed to achieve research excellence in any country is most often set as above 1.5% of GDP. At present, Africa's participation in global knowledge generation remains negligible compared with the rest of the world. Figures from the World Bank show that Africa produces below 1% of global scientific knowledge, despite being inhabited by 16% of the global population. Estimates from UNESCO's Institute of Statistics (UIS) for 2019 Africa's funding of R&D stands at 0.42% of the continent's GDP, which is far below the global average of 1.7% and the lowest in the world. At continental level, a decision was made by the African Union's Executive Council in 2006 to establish a target for all Member States of 1% of GDP investment in R&D in order to improve innovation, productivity and economic growth. However, data from the UIS show that only South Africa, Kenya and Senegal are close to meeting this target, with about 0.8% of their GDP dedicated to R&D.

Research is still underfunded in Africa and yet there are lots of opened questions in area of meteorology and climate change. For a full implementation of NFWCS, for instance, adequate tailored products to fit users' must be developed. And in NWP and satellite products, the continent heavily relies on the Global Producing Centres (GPCs) and EUMETSAT. For climate change adaptation plans and national development plans, scientific information is often not available at spatial and timescale of use by policymakers. These issues need to be addressed by African researchers in collaboration with international researchers. There is need to understand the indigenous knowledge at community level in the traditional forecasting system and methodologies used to predict weather and climate.

Massive academic training and short-term training for professionals in all aspects of meteorology are needed to ensure critical mass in NMHSs to deliver adequate services.

The areas of action are to:

- Ensure that at least 5% of budgets allocated to NMHSs and associated research institutions, at the national level, is for research, innovation development.
- Encourage NMHSs and RCCs to collaborate with the Climate Research for Development in Africa initiative (CR4D) of ACPC/United Nations Economic Commission for Africa (UNECA) under the aegis of Regional Climate Research Partnership⁴³ in the design, resourcing and production of user-driven climate information and services.
- Collaborate with local communities to unravel and understand the scientific basis of indigenous knowledge used at community level in the traditional forecasting system and methodologies applied in predicting weather and climate.
- Strengthen cooperation and collaboration with international scientific and technical partners including GPCs to ensure that African NMHSs and RCCs can access NWP, satellite, and climate products for research as well as exchange and contribute scientific and technical information with these partners.

⁴³ https://archive.uneca.org/sites/default/files/PublicationFiles/cr4d-climate_research_for_development_in_africa_en_brochure.pdf

- Collaborate with existing initiatives⁴⁴ and relevant African institutions,⁴⁵ on training and research to ensure the convergence and complementarity of initiatives and programmes.
- Work with academic institutions, including WMO Regional Training Centres to supply trained and competent people, and to update and develop training curricula in line with contemporary needs and requirements and engage Ministries of Education and Research.
- Increase African capacities to develop African-tailored products based on satellite data, through an African Meteorological Satellite Application Facility (AMSAF) as proposed by the Abidjan Declaration, and engage with international partners to combine or assimilate in situ observations, model outputs and satellite-derived products to better address African requirements.
- Stimulate national and regional research activities on DRR and climate change, and also in other important areas such as health, agriculture, energy and water, in collaboration with WMO, partners and sponsored research programmes such as Global Atmosphere Watch, WWRP and WCRP. WMO is focusing on integrative science to respond to the international disaster risk and climate agenda towards a society resilient to extremes, climate variability and change. Collaborative research demonstrates how diverse research communities can tackle issues of common interest and deliver tangible and measurable outcomes in a short time frame.
- Build scientific, technical and managerial capacities of NMHSs and RCCs for quality services through collaboration with WMO global or advanced regional centres.
- Increase Africa's participation to the IPCC process through funding of publication of climate research.

SP5: Strengthened partnerships with relevant institutions and the private sector

The success of the Strategy is highly dependent on the strength of the partnerships. These partnerships are with existing institutions that support and collaborate with AMCOMET, funding institutions and Civil Societies that are able to provide the necessary financial resources to meet the goals. The Strategy must be clearly linked with the work of government departments and agencies, technical partners, the private sector and other relevant stakeholders, and work in collaboration with global and regional frameworks, including the Africa Hydromet Program.⁴⁶ AMCOMET plays a pivotal role in harnessing and developing these relationships, to optimize production and delivery of weather, water and climate services, and in the co-design, co-development and co-production of knowledge.

⁴⁴ Such as ClimDev-Africa, the Intra African, Caribbean, and Pacific Group of States Climate Services and related applications programmes, Southern African Science Service Centre for Climate Change and Adaptive Land Management, West African Science Service Centre on Climate Change and Adapted Land Use, and the Global Monitoring for Environment and Security and Africa programme.

⁴⁵ Such as the African Climate Policy Centre, the African Centre of Meteorological Applications for Development, and WMO RCCs and Regional Training Centres.

⁴⁶ http://www.worldbank.org/en/programs/africa_hydromet_program.

The areas of action are to:

- Cultivate long-term partnerships with traditional financing institutions such as development banks and aid agencies, to ensure their involvement in the AMCOMET process, thus paving the way for institutional and financial support.
- Identify funding streams established to support African countries in their development efforts including through improvement of meteorological infrastructure and services, and work to ensure efforts are focused on Africa's priorities and are adequately coordinated.
- Liaise with the UNECA and the private sector for the development and implementation of innovative business models that ensure growth and sustainability of NMHSs/RCCs.
- Develop policy and legal framework for Public-Private Engagement (PPE) in a mutually beneficial Public-Private Partnership (PPP) between the private sector firms under the emerging Global Weather Enterprise (GWE) and the NMHSs in Africa. Actively involve other private sector players and Civil Societies to strengthen NMHSs and support the implementation of the Strategy.
- Involve the Climate Financing institutions such as GEF and GCF to support investments in NMHSs required for the development of weather, water and climate services for EWS.

IMPLEMENTATION, RISKS AND ASSUMPTIONS

The key issues in implementation of the Strategy are **recognition and acknowledgement by all stakeholders**, including national governments, of the strategic nature of NMHSs, and the critical and pivotal role they play in national security, national stability and socioeconomic development of every country.

A key assumption is therefore made that Members will continue to recognize the NMHSs as an Essential Service and resource their NMHSs both in terms of human resources and infrastructure. Another assumption is that Membership contributions are up to date to sustain the AMCOMET Secretariat and its operations.

These NMHSs are increasingly being called upon to urgently respond to the ever-increasing and varied needs of societies, the effects of climate variability and change, and the new opportunities arising from technological advances.

Therefore, Members and continental institutions, with the support of development partners, should commit to implementing the Strategy by improving the visibility and recognizing the added value of NMHSs within countries and also by improving the sustainability, effectiveness, flexibility and efficiency of their structures as well as working mechanisms and practices.

A risk management process is generally implemented as part of a TQM initiative. The AMCOMET Secretariat and the AMCOMET Bureau shall be responsible for adopting the best approach and business model to minimize the risks of the Strategy implementation, building on the *WMO Risk Management Framework* (WMO-No. 1111)⁴⁷ and Guidelines.

⁴⁷ https://library.wmo.int/index.php?lvl=notice_display&id=14740#.YED3Y2hKiUk

Modalities of the implementation of the Strategy need to be crafted in accordance with the priorities of African Union and AMCOMET as well as the availability of financial resources. There are associated risks (R) and assumptions (A) that should be taken note of and considered, including the following:

- Political unrest and disturbances in African countries (R);
- Absence of legal and institutional frameworks in many countries;
- Inadequate financial national resource allocations to NMHSs (R);
- Private sector and other institutions delivering weather and climate services (R);
- Political realignment with development partners (R) because some donor aid comes with political conditions or work with preferred countries, resulting in funding gaps in some NMHSs;
- HIV/AIDS, epidemics (like malaria, dengue, meningitis, typhoid and cholera (R), pandemics (like COVID19), other drastic hazards that disrupt operations and functions of NMHSs;
- High turnover of technical staff to “greener pastures”, frequent staff changes (R) and natural attrition (staff retirement or death) (R);
- Unavailability of appropriate skilled human resources (R), particularly in weather forecasting, data archiving and data mining, as well as data quality control and climate modelling;
- Unconducive environment for recruitment of women (A), in the context of adaptation and mitigation to climate change.

As part of the analysis undertaken to develop this strategy, some risks were identified, and a prevention plan could be design, for example:

Type of risks	Prevention plan
Lack of financial resources to execute the strategy	<ul style="list-style-type: none"> • Organization by anticipation of the stakeholder’s meetings, prior to the dissemination of the National Development plans, so that the Meteo and Climate components are well present with the national strategies; • Knowledgeable use of international and regional grants; • Co-design and co-construction of strategic plans with AMCOMET designated key experts and/or WMO consultants selected by the NMHSs.
Lack of optimized infrastructures and technology at RCCs and regional level	<ul style="list-style-type: none"> • Better knowledge of the international requirements and implementation of New Technological systems; • Better articulation of RCCs value proposition and sustainable business models; • Optimized use of satellite infrastructure; • Implementation of Human Resources planning and management at NMHSs.
Lack of quality of data delivered, especially in aviation and marine	<ul style="list-style-type: none"> • Support from NHMSs regional centres to help implement good practices in quality management; • Design of different business models for data generation and data quality assurance: transformation of data collection into knowledgeable information for decision makers; • Optimized usage of the new recruits and experienced engineers/technicians through mentoring and coaching programmes.
Lack of visibility of NMHSs	<ul style="list-style-type: none"> • Development of the AMCOMET index to measure the progress in understanding the strategic role of NHMS in Africa with positive communication on the impact of hydromet tailored services for the socioeconomic development of the continent; • Development of impact-based studies and dissemination of these on regular basis at subregional, continental, and international levels.
Lack of Human resources with modern management competencies in the NMHSs	<ul style="list-style-type: none"> • Development and implementation of staff succession management strategies for NMHSs; • Design and implementation of strategic Human Resource management plans, including midterm and long-term training; • Implementation of a full capacity development programme with modern topics including coaching, mentoring programmes, leadership and communications workshops, etc.

INSTITUTIONAL ARRANGEMENTS

Institutions and structures are already in place to support the implementation of the Strategy. The development of the Strategy has involved the participation of WMO Regional Office for Africa, AUC, RECs, national authorities, and development partners through a consultative process. This participatory approach will continue throughout the implementation process. Specific roles and responsibilities will be defined in the implementation plan for the Strategy at the continental, regional and national levels by key stakeholders.

The ClimDev-Africa is a good joint initiative of AfDB, AUC and UNECA, that supports the implementation of the strategy. It seeks ways of overcoming the lack of necessary climate information required by policymakers and decision makers at all levels. However, a more regional approach will be more beneficial for the continent.

In addition to NMHSs, other African stakeholders, including the private sector and civil society organizations, should also be consulted and involved. International stakeholders, as partners, should participate in the implementation of the Strategy and align their support with SPs and identified needs. As these partners are key to the co-design, co-development, and co-delivery of services with NMHSs, it is recommended that NMHSs increase efforts in collaborating with them at national level.

Task forces

To work on prevention plans and anticipate better risks, AMCOMET and partners need to establish task forces in priority activities to:

- Design a complete logical framework linking SPs, strategic objectives, relevant strategic indicators and programmatic initiatives;
- Update the risk register, rank the risks, and develop appropriate mitigating actions against the top risks;
- Review and follow, together with AMCOMET Bureau and the Secretariat, at least once a year the Implementation and Resource Mobilization Plan of the Integrated African Strategy on Meteorology (Weather and Climate Services)⁴⁸ with its detailed annual operational plans;
- Review and follow the resource mobilization strategy⁴⁹ for the implementation plan together with AMCOMET budget and programmatic activities;
- Explore the feasibility of developing and establishing AMSAF, leading to the generation of Africa-tailored satellite products answering to African socioeconomic requirements, based on the four main components of the WMO Space Programme and in line with the African Space Policy and Strategy⁵⁰;
- Maintain and develop ongoing efforts of meteorology and climate research and services (for example, CR4D) with academia.

AMCOMET Members should be encouraged to pursue dialogue with other countries, especially those with more advanced capabilities, to better understand how best to organize and support weather, water and climate services in their respective countries.

⁴⁸https://www.wmo.int/amcomet/sites/default/files/field/doc/events/doc.4.0_approved_implementation_and_rm_plan_en.pdf.

⁴⁹ https://www.wmo.int/amcomet/sites/default/files/field/doc/events/annex_6_rmdp_0.pdf.

⁵⁰https://www.wmo.int/amcomet/sites/default/files/field/doc/events/1_report_tf_space_programme_0.pdf.

RESOURCE MOBILIZATION

To ensure smooth implementation of the Strategy, resource mobilization efforts are needed in alignment with the institutional arrangements and coordination modalities established in the Strategy. Resource mobilization for the Strategy will focus on:

- Further mobilizing resources from African countries and institutions;
- Aligning the Strategy's needs and requirements on available and potential financing sources;
- Collaborating and coordinating with various resource partners, including multilateral funding mechanisms, bilateral development agencies and multilateral development banks;
- Working closely with partners that already include the Strategy in their priority areas of focus, as well as other strategic development partners such as AfDB, the World Bank, the European Union, and the African, Caribbean, and Pacific Group of States Secretariat;
- Identifying funding trends and sources, as well as resource mobilization scenarios, in considering the challenges posed by the current global financial and economic crisis;
- Demonstrating the socioeconomic benefits and returns for the investment in weather and climate services;
- Embracing the Hydromet Alliance Initiative that is being coordinated by WMO and the Systematic Observations Financing Facility (SOFF).

MONITORING, EVALUATION AND REPORTING

The implementation of the Strategy shall be reviewed under the planning cycle of AMCOMET. Monitoring and evaluation will be conducted in accordance with the WMO Monitoring and Evaluation System.⁵¹ An appropriate monitoring and evaluation tool needs to be developed to ensure periodic reporting from focal points and stakeholders. It is expected that AMCOMET, WMO Regional Office for Africa, AUC, RECs and national governments will have key roles in this process.

To monitor the progress towards achieving the objectives of the Strategy, data and information will be collected to measure the progress against the expected outcomes of the Strategy, recalling some of the key ones:

- Increased recognition of NMHS roles at the political level;
- Accelerated implementation of the AU Gender Policy and Youth Strategies, as well as WMO Gender Action Plan;
- Improved EWS and climate risk management for the protection of life and property;
- Increased safety on land, on water and in the air;
- Enhanced quality of life;
- Enhanced cooperation among African countries.

⁵¹ https://www.wmo.int/pages/about/documents/1088-WMO-monitoring-and-evaluation-Guide_en.pdf.

Strategic indicators need to be implemented to measure the progress and should include regional, subregional and national indicators such as:

- Degree of regional cooperation in Africa;
- Degree of involvement of NMHSs in relevant government agendas;
- Percentage of enhanced capacity (technical, human and financial) of NMHSs in providing tailored weather, water and climate services;
- Percentage of enhanced capacity (technical, human and financial) of RCCs in providing sector-specific weather and climate services;
- Number of designated meteorological authorities for aviation services providing meteorological services for international air navigation;
- Performance in delivering services to major users (through measures providing a global index on user satisfaction of hydromet services delivered);
- Percentage of NMHSs that comply with the requirements of ICAO and WMO, including QMSs and aeronautical meteorological personnel competency;
- Percentage of NMHSs that are certified to ISO 9001:2015;
- Percentage of increased resources invested in the strengthening of NMHSs (national versus international);
- Percentage of NMHSs that implement a gender action plan, aligned with AUC and/or WMO recommendations.

Possible aligned Key Performance Indicators⁵² could be as follows:

- Number of regional initiatives where activities are aligned with AMCOMET objectives and vision;
- Number of subregional initiatives where activities are aligned with AMCOMET objectives and vision;
- Percentage of increased budget for AMCOMET-related activities;
- Number of projects co-designed with stakeholders from the private and public sectors;
- Number of research projects and programmes co-designed and co-developed with academia;
- Number of international publications on a yearly basis with the AMCOMET stamp;
- Number of stakeholders and development partners events where AMCOMET contributed;
- Number of user and development partner events organized by AMCOMET;
- Calculated return on investment for each organized and/or co-organized event;

⁵² A **key performance indicator (KPI)** allows to assess the success and progress of the implementation of a strategy, against its set of strategic objectives. Choosing the right KPIs relies upon a good understanding of what is important to the association, in this case the AMCOMET. To design the right KPIs, a good analysis (SWOT, Stakeholders, ...) is key, so the Logical Framework of activities would link these objectives with the relevant expected outcomes/results and associate with the selection of performance indicators.

- Rate of satisfaction of stakeholders on a yearly basis (an index could be generated around the AMCOMET brand);
- Compliance with ISO 9001:2015 for AMCOMET (leading by example);
- Advancement in knowledge management (sharing data, information and knowledge through social media);
- Percentage of women participating in decision-making bodies, governance structures and user forums in the AMCOMET environment (activities to measure this specific gender-related indicator could include awareness programmes for women and girls in science, technology, engineering and mathematics, in partnership with non-governmental organizations, academia and so forth); a series of gender-sensitive indicators should be generated;
- Number of NMHSs with strategic plans aligning global agenda (e.g. SDGs, Sendai Framework, etc) with Regional Agenda (AU Agenda 2063) and with national development programmes (e.g. Vision 2030, 2025, etc) and complying with the proposed WMO framework for strategic planning process;
- Number of NFWCSs complying with GFCS, and adopted by national governments;
- Percentage of capacity-development programmes specifically dedicated to the enhancement of weather, water and climate services at the Africa level.

ANNEX: SWOT ANALYSIS

Strengths	Weaknesses
<ul style="list-style-type: none"> - NMHSs are usually the sole designated national authorities and chief advisers to governments on matters relating to meteorology, climatology and water resources; - NMHSs own and operate the basic observing systems according to international standards, which exchange data and yield the information required for global, regional and national understanding of weather, water and climate phenomenon; - Meteorology and hydrology play a key role in the national security; information derived from these sectors are recognized as key elements in delivering services for socioeconomic development (food security, disaster risk reduction, water resources, energy); - Opportunities for R&D collaboration between the NMHSs and the public/private sectors, across scientific disciplines and technical domains (health, seismology, agriculture, marine, dedicated media content for public education, etc.); - Increased collaboration in some countries with the national media stakeholders to develop the relevant knowledge (education content, risk management) on disasters and hazards faced by the community; - NMHS deliver critical service to collect and ensure quality of the climate data; - Goodwill for harmonization of African policies in weather, climate, water and sustainable development; - Increased number of partnerships since AMCOMET was established; - Increased use of the WMO strategic planning and GFCS frameworks, key tools to mainstream meteorology, hydrology and climate at the national development level. 	<ul style="list-style-type: none"> - Continued lack of visibility and inadequate financial support from national governments; - Low capacity of NMHSs to undertake the continuous modernization; - Meteorological and hydrological information and services are not systematically taken into consideration in developing National Development Plans; - Lack of strategic planning competencies and processes, including human resource planning (no Human Resources manuals with clear job descriptions, unequal management and project management capacity, poor capacity development plans, no retention and recruitment plans for high qualified expertise; etc.); - Lack of tools, processes and competencies in: marketing and communication, monitoring and evaluation, total quality management, strategic indicators follow-up, etc.; - Lack of African case studies communication, which demonstrate links between optimized service delivery and socioeconomic growth in a country; - Language diversity across Africa may reduce collaboration between countries; - Intracontinental travel can be costly and time consuming; - Lack of alignment between NMHSs strategic plans (when existing), national governments development plans; - Lack of capacity to access and exploit observation and products available at global level (meteorological satellites, global NWP outputs, big climate data store, cloud computing).

Opportunities	Threats
<ul style="list-style-type: none"> - Growing awareness of the public and the decision makers on the value added of weather and climate services; - Climate change is a high level political and developmental issue; - Climate information at various timescales is required for adaptation and can bring relevant knowledge for decision-making at high level; - Existence of international and development partners and funding agencies as a potential source of resources to help improved relevant capacity in the continent; - Availability of continuous satellite observation over Africa until 2040 with the launch of the Meteosat Third Generation satellites; - The clear need for NMHSs to work with different national, subregional and regional stakeholders to provide quality climate services, strengthen partnerships and coordination; take advantage of south-south cooperation and partnerships; - Availability of global, regional and subregional centres, including WMO Regional Training Centre (eight WMO RTCs) spread through the region, to help enhance product quality, human capital and infrastructural development; - The increasingly prominent role played by the private sector as a complementary source in providing climate and weather information could generate opportunities of collaboration for NMHS in Africa - Growth of the WMO GDPFS, bringing new products and service enhancement options to national centres, from global and regional centres; - RFCS and NFCS of the GFCS in Africa are not yet functional; - Growing awareness for Gender issues, including at internal level (recruitment, career development, etc.) and at beneficiary level (Gender in the context of weather- and climate-sensitive sectors, such as disaster risk reduction, water, health, agriculture, etc.); gender perspective growing worldwide. 	<ul style="list-style-type: none"> - Lack of legal frameworks for establishment of NMHSs in many Member countries; - Inaction vis a vis private sector usually quite active in the same domains; - Globalization of weather and climate issues through international media and research institutions/projects without proper attention to national or local requirements (lack of co-design); - No access to rapidly advancing science and technologies developed at global level for weather and climate monitoring and forecasting (meteorological satellite, cloud computing, big data); - Political instability in some countries.

LIST OF ACRONYMS

ACFTA	African Continental Free Trade Area
ACMAD	African Centre of Meteorological Applications for Development
ACP	Africa-Caribbean-Pacific
ACPC	African Climate Policy Centre
AFD	Agence Française de Développement
AfDB	African Development Bank
AGN	African Group of Negotiators
AGRHYMET	Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle
AMCEN	African Ministerial Conference on Environment
AMCOST	African Ministerial Conference on Science and Technology
AMCOW	African Ministers Conference on Water
AMESD	African Environment for Sustainable Development
AMSAF	African Meteorological Satellite Application Facility
AMU/UMA	Arab Maghreb Union
ASECNA	Agency for the Safety of Aerial Navigation in Africa
AUC	African Union Commission
C3S	Copernicus Climate Change Service
CAHOSCC	Conference of African Heads of States and Government on Climate Change
CAMS	Copernicus Atmosphere Monitoring Service
CEMAC	Economic and Monetary Community of Central Africa
CENSAD	Community of Sahel-Saharan States
CG	WMO Congress (when referred to as Cg-17)
CILSS	Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel
CLIMDev	Consultative Group to Review the Climate for Development Africa
CMEMS	Copernicus Marine Environment Monitoring Service
COMESA	Common Market for Eastern and Southern Africa
COP	Conference Of Parties
CR4D	Regional Climate Research Partnership
CSIS	Climate Services Information System
CUIP	Climate User Interface Programme
DCPC	Data Collection and Production Centres
DFID	Department for International Development (UK)
DRR	Disaster Risk Reduction
EAC	East African Community
ECCAS	Economic Community of Central African States

ECOWAS	Economic Community of West African States
EM-DAT	Emergency Events Database
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EWS	Early Warning Systems
GBON	Global Basic Observing Network
GCDS	Global Climate Data Store
GCF	Green Climate Fund
GDPFS	Global Data-processing and Forecasting Systems
GFCS	Global Framework for Climate Services
GHACOF	Greater Horn of Africa Climate Outlook Forum
GMDSS	Global Maritime Distress and Safety System
GMES	Global Monitoring for Environment and Security
GPC	Global Producing Centres
GTS	Global Telecommunications System
GWE	Global Weather Enterprise
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICPAC	IGAD Climate Prediction and Applications Centre
ICT	Information and Communication Technology
IGAD	Intergovernmental Authority on Development
IMO	International Migration Organization
IOC	Indian Ocean Commission
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standardization Organization
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
LDCs	Least Developed Countries
MASA	Meteorological Association of Southern Africa
MDGs	Millennium Development Goals
MESA	Monitoring of Environment and Security in Africa
MTG	Meteosat Third Generation
NAPs	National Adaptation Plans
NCEP	National Centres for Environmental Prediction
NCOF	National Climate Outlook Forums
NEPAD	New Partnership for Africa's Development
NFCS	National Framework for Climate Services

NFWWCS	National Framework for Weather, Water and Climate Services
NGOs	Non Governmental Organizations
NMHSs	National Meteorological and Hydrological Services
NMSs	National Meteorological Services
NWP	Numerical Weather Prediction
PPE	Public-Private Engagement
PRESAGG	Prévisions Climatiques Saisonnières pour les pays du Golfe de Guinée
PRESANORD	Prévisions Climatiques Saisonnières en Afrique du Nord
PRESASS	Prévisions Climatiques Saisonnières en Afrique Soudano-Sahélienne
PR(s)	Permanent Representative(s)
QMS	Quality Management Systems
RBON	Regional Basic Observing Network
RCCs	Regional Climate Centres
RECs	Regional Economic Communities
RASCOM	Regional African Satellite Communications Organization
RCOF	Regional and Climate Outlook Forums
RFCS	Regional Framework for Climate Services
RSMC	Regional Specialized Meteorological Centres
RTCs	WMO Regional Training Centres
SADC-CSC	Southern African Development Community-Climate Services Centre
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
SDGs	Sustainable Development Goals
SP	Strategic Pillar
STC	Specialized Technical Committee
STC ARDWE	Specialized Technical Committee on Agriculture, Rural Development, Water and Environment
STEM	Science, Technology, Engineering, Mathematics
SWIOCOF	South West Indian Ocean Climate Outlook Forum
SWOT	Strengths, Weaknesses, Opportunities and Threats
TICAD V	Fifth Tokyo International Conference on African Development
TQM	Total Quality Management
UIS	UNESCO's Institute of Statistics
UMA	Union du Maghreb Arabe
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNECA	United Nations Economic Commission for Africa

UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations Strategy on Disaster Reduction
UNCCD	United Nations Convention to Combat Desertification
US-AID	United States Agency for International Development
WASCAL	West African Science Service Centre on Climate Change and Adapted Land Use
WB	World Bank
WCC-3	World Climate Conference-3
WCRP	World Climate Research programme
WIS	WMO Information Systems
WIGOS	WMO Integrated Global Observing Systems
WMO	World Meteorological Organization
WMIWS	Worldwide Met-Ocean Information and Warning Service
WWRP	World Weather Research Programme
