

# Consultative Workshop on the Co-development of National Framework for Weather, Water and Climate Services (NFWWCS) for the Southern Africa sub-region

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Workshop Report



**AICCRA**  
Accelerating Impacts of CGIAR  
Climate Research for Africa



# **Consultative Workshop on the Co-development of National Framework for Weather, Water and Climate Services (NFWWCS) for the Southern Africa sub-region**

## **Workshop Report**

**Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA)**

**December 2022**

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**About AICCRA**

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## Summary

*A three-day experience-sharing workshop was held in Cape Town, South Africa, from 28 to 30 September 2022 to support the co-development of National Framework for Weather, Water and Climate Services (NFWWCS) for the Southern Africa countries. This workshop is a follow-up on the successful co-development and endorsement of AICCRA-supported National Framework for Climate Services (NFCS) in Ethiopia and the subsequent two regional workshops for IGAD and SADC member States held in Zanzibar and Kampala to explore regional landscape in the development and implementation of NFWWCS. The representatives presented their progresses on the planning and development of the NFWWCS, types of weather and climate services offered by their NMHSs and the experiences, lessons learnt, and best practices in the development of the NFWWCS. The progresses were reported in accordance with the Global Framework for Climate Services (GFCS) step-by-step guidelines for NFCS. Strategic and operational challenges faced by the countries including gaps and barriers that inhibits the successful development and implementation of the NFWWCS were discussed. Further to the presentations made by the Southern Africa countries, round table discussions groups were organized in the form of breakaway sessions to surface and deep dive into common challenges, experiences, gaps and barriers to the successful planning and development and implementation of the NFWWCS. The outcome of each working group was presented to the broader participating audience. The audience pondered on solutions that could bridge the gaps that exists in Southern Africa countries that lead to NFWWCS development paralysis. The workshop was concluded by a methodical summarization of the challenges, interventions and way forward proposed for each of the country. The interventions and way forward included country specific solutions that could empower each country, in particular those that are at step zero, to get going while those that have started to progress to the next stages of the NFWWCS development. Common challenges across all Southern Africa countries are associated with lack or limited financial resources to fund the development of the NFWWCS, lack of support and buy-in from national government and political leaders in the respective countries and participation on staff members who are not decision makers. Broader requests included the need to develop a regional framework for weather, water, and climate services, that will drive regional programmes (funding, research, etc.) and assist in accelerating the implementation of NFWWCSs across all the SADC countries. Participants from the Southern Africa countries commended the relevance of this platform and recommended that the support should continue ad infinitum to ramp the development of NFWWCS across all countries. Accordingly, countries at stage zero or stage one requested to have such platform where they can learn more from the Accelerating Impacts of CGIAR Climate Research for Africa in Eastern and Southern Africa (AICCRA ESA) program's experience in Ethiopia and elsewhere. The AICCRA and its regional collaborating partners' – the African Climate Policy Centre (ACPC), World Meteorological Organization – Regional office Africa (WMO-RoA) and the IGAD Prediction and Application Centre (ICPAC) – efforts helped NMHSs to successfully plan, develop and implement NFWWCS and its action plan to strengthen their national adaptive capacities. This workshop was attended by representatives from SADC member countries and their partnering organizations.*

# 1. Introduction

African countries have identified climate change as a developmental challenge that has the potential to reverse economic developments made over time, which requires them to undertake national and regional measures to climate change to protect the economy, environment and livelihoods<sup>1</sup>. The negative effect of climate change on social, economic and environmental systems have, therefore, intensified the calls from various stakeholders to generate and deploy appropriate climate information in their decision-making processes (Vincent et al., 2015)<sup>2</sup>. The climate information service (CIS) known to provide valuable information on weather forecasts, early warning, seasonal forecasts and others to the end-users based on past, present, and future climate so as to maximize the benefits of climate knowledge and reduce the impacts of climate change. The provision of quality and timely CIS to various stakeholders through a holistic approach and that it mainstreams and integrates CIS into all levels of planning and implementation at regional, national and subnational levels. However, the range of activities associated with the generation and delivery of science-based climate prediction and services depends on the availability and access to physical infrastructure for observations, monitoring and prediction of climate and non-climatic variables. Moreover, sufficient capacity in the development, delivery and evaluation of CIS are critical to prepare for climate changes and enhance cross-sectoral climate resilient development.

Investing in weather and climate services improves information, such as better forecasts, early warning and seasonal forecasts as this information provide economic benefits and bring positive outcomes from the actions and decisions that users subsequently take (WMO, 2015)<sup>3</sup>. Bridging the gap between the climate information being developed by scientists and service providers and the practical needs of users are, therefore, critical to make the right decision in most climate sensitive sectors, weather risk management and climate change adaptation and mitigation initiatives. This necessitates a national as well as regional mechanism to improve co-production, tailoring, delivery and use of science-based climate predictions and services. Accordingly, member States advised and later agreed to establish the National Framework for Climate Services (NFCS), which is recently renamed as a National Framework for Weather, Water and Climate Services (NFWWCS), to assist the coordination, facilitation, collaboration as well as improvement of the co-production, tailoring, delivery and utilization of CIS by the end-users.

The NFWWCS recently attracts an increased political support and institutional collaborations for enhanced weather and climate services delivery to end users and improve access to weather and climate services by the climate sensitive sectors such as agriculture (crop production and animal husbandry), health, energy, water resources and disaster risk reduction. This framework also underscores the need for strengthening partnership and collaboration with relevant institutions; increased support in the provision of weather and climate services; and strengthening research efforts to address existing research gaps and needs as well as promoting provision of and access to climate services as stated in the Global Framework for Climate Services (GFCS) website (<https://gfcs.wmo.int/>). Accordingly, several African countries have taken tangible steps to enhance the resilience of the most vulnerable communities to the adverse impacts of climate variability and change, through promoting the use of CIS at all levels. One of such steps is the development and implementation of the NFWWCS to coordinate, facilitate and strengthen collaboration among national institutions and other key stakeholders to improve the co-production, tailoring, delivery, and use of science-based climate services.

In this context, the Accelerating Impacts of CGIAR Climate Research for Africa in Eastern and Southern Africa (AICCRA ESA) program in partnership with the African Climate Policy Centre (ACPC), the World Meteorological Organization – Regional office Africa (WMO–RoA) and IGAD

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<sup>1</sup> <https://www.uneca.org/acpc>

<sup>2</sup> Jones, L., Dougill, A., Jones, RG *et al.* (11 more authors) (2015). Ensuring climate information guides long-term development. *Nature Climate Change*, 5, 812 - 814.

<sup>3</sup> WMO (2015). WMO Guidelines on Multi-hazards Impact-based Forecast and Warning Services

Climate Prediction and Application Centre (ICPAC) is working to make CIS more accessible to millions of smallholder farmers across Africa. Following the successful co-development and endorsement of the partly AICCRA supported NFCS in Ethiopia, two regional workshops have been organized in Zanzibar and Kampala to explore regional landscape in the development and implementation of NFCS and thereby reaches to the spill-over countries. This cross-regional and south-south consultative learning and knowledge-sharing regional workshop brought various stakeholders from Eastern and Southern Africa countries including their respective WMO Permanent Representatives, National Meteorology and Hydrology Services (NMHS) experts, the regional climate centres as well as the UN agencies. At the end of the above workshops, participants commend the relevance of such platform and called for a follow-up support that take into account the specific requirements of the member States. Accordingly, countries at lower stage requested to have such platform where they can learn more from the AICCRA's experiences in Ethiopia and elsewhere. Encouraging member states, among other, through the provision of experience-sharing platform is critical, as it will help them to capitalize on good practices and innovative ideas to accelerate the development and implementation of the NFWWCS in their respective country.

This consultative process aimed at providing platform for both climate service providers and users within the various sectors in order to identify gaps in climate services knowledge production and use through participatory processes. According to the NFCS step-by-step guideline of GFCS<sup>4</sup>, the first step in establishing an NFCS is to assess existing capacities and have a baseline. Assessing the level of capacity of all the stakeholders covering the full climate services cycle from development to use at national and local levels will help identify the critical gaps that exist to co-produce, deliver, communicate, use and evaluate salient climate services and determine opportunities for improvement. The assessment should also include the status of climate services provided by the NMHS; technical partners in co-production; and indigenous knowledge from local communities, academia and experts from climate-dependent sectors such as agriculture, civil protection agencies, health, water resource management, energy, transport, architecture, civil engineering, infrastructure, military, building/construction industry and police.

The AICCRA and its partners had, therefore, organized a regional workshop in Cape Town, South Africa, from 28-30 September 2022, to provide opportunity to countries in Southern Africa region to learn from Ethiopia's and South Africa's experiences and fast-start/accelerate the co-development of NFCS in their respective countries. This workshop was attended by representatives from SADC member countries and their partnering organizations.

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<sup>4</sup> [https://library.wmo.int/doc\\_num.php?explnum\\_id=4335](https://library.wmo.int/doc_num.php?explnum_id=4335)



## 2. Opening Session

### 2.1. Welcoming Remarks

On behalf of Dr. Yonas Mphepya, the managing Director of the SAWS, Ms. Merci Beaucoup welcomed participants to the SADC NFCS workshop. She also appreciated the honour granted to the SAWS to co-host this significant workshop with the ILRI-AICCRA, UNECA-ACPC, WMO-RoA and IWMI-AICCRA that aimed at empowering the NMHSs, enhancing the regional co-operation, and advancing climate services in the SADC sub-region. Specifically, it is a great privilege to address the workshop as it supports the development and utilization of CIS in reducing the impacts of disasters from hydro-meteorological hazards. It also capacitates experts and communities to adapt to the climate change and variability. Without doubt, the effective and sustained delivery of CIS in our sub-region is crucial for the achievement of the Paris Agreement's adaptation goal of *"enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change"*. This workshop is convened at an opportune time that requires a holistic approach and regional concerted efforts for the development and review of NFCS. This regional collaboration and sharing of experiences and expertise will ensure the successful development of frameworks at national levels (NFCS), with the futuristic goal of developing the SADC Regional Framework for Climate Services. Both are requirements of the GFCS. Finally, she concluded her speech by welcoming all to the Republic of South Africa and to the beautiful "Mother City". Thank you very much!

### 2.2. Opening Remarks

Dr. Amos Makarau, Director of the WMO-RoA, started his opening speech by stressing the importance of CIS in guiding our decision making process. The CIS provides the science-based and user-specific information for managing risks and exploiting opportunities created by climate variability and change, thereby helping society to become more resilient in coping with the increasing impacts of climate change. The provision of quality and timely CIS to end-users, however, require the generation, analysis, and sharing of adequate hydro-climate data that enable end-users to fully understand climate phenomenon, develop appropriate early warning system, and make the necessary decisions. It is also envisioned that improvements in climate services could only be realized if relevant institutions at global, regional and national levels work together to complement their efforts by sharing expertise and data in their respective areas of specializations and mandate to inform the development and delivery of high-quality user-oriented climate services. Hence, improving the capacities and competencies of NMHSs, national climate training and research institutes, regional climate centres such as SADC-CSC and other climate related organizations is crucial to develop more science based reliable and useful CIS. Consequently, the WMO's GFCS is focusing on developing and delivering services in five priority areas (i.e., agriculture and food security; disaster risk reduction; energy; health; and water) that address issues basic to the human condition and present the immediate opportunities for benefitting human safety and well-being. The creation of a NFCS is, therefore, recommended to help coordinate, facilitate, and strengthen collaboration among the climate services community and improve the co-production, tailoring, delivery and use of science-based climate information and services. WMO-RoA encouraged countries in the SADC region to produce their own NFCS to be able to properly benefit from public and private sector programmes and initiatives. In this regard, he affirms that the WMO-RoA will continue to support the AICCRA's initiative aiming at the co-development of NFCS in the SADC as well as other sub-regions. The AICCRA, ACPC and WMO's supports to eastern and southern Africa countries underscore the importance of strong partnership in producing and delivery of climate services as well as in building resilience of communities and economies occasioned by climate change. Finally, he wished participants a fruitful deliberation and declared that the workshop is officially opened.

### 3. Setting the scene

#### 3.1. Guidelines for the Development of National Frameworks for Weather, Water and Climate Services (NFWWCS)

The guidelines for the development of National Frameworks for Weather, Water and Climate Services (NFWWCS) by Mr. Mabu Mamadi, a consultant for National/Regional Frameworks for Water, Weather and Climate Services, South Africa. Given a specialized agency of the United Nations dedicated to international cooperation and coordination on the state and behavior of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces, and the resulting distribution of water resources<sup>5</sup>, the WMO – through its GFCS – had developed a step-by-step guidelines for the development of the NFCS<sup>6</sup>. The NFCS is being developed under the umbrella of the GFCS to harness both scientific and technological advances and thereby enhance the development of tailored climate forecasts and predictions in support of decision-making in climate risk management and adaptation planning. The NFCS acts as a coordinating and institutional platform for all stakeholders involved in the climate services value chain to allow the co-designing and co-development of customized climate services to the end-users. However, the initial NFCS failed to cover water and weather components in detail and now decided to include them under the new name called the NFWWCS. Expanding the concept of a user-driven NFCS to include weather, water, and climate services is an important milestone at national level but effort also put in place to establish the Regional Frameworks for Weather, Water, and Climate Services (RFWCS) to enable the development and application of climate services at regional levels.

The NMHSs are the custodians to provide climate predictions and forecasts that meet the demands of users in climate-vulnerable sectors. However, the provision of effective climate services is impeded by the absence of a connection between users and producers. This is typically exacerbated by NMHSs' inadequate institutional capacity to promote such contact within their country setting. The NFCS could, therefore, offer NMHSs the opportunity to take the lead in the co-design, co-development, and provision of climate services (user-driven). Frameworks aided in overcoming operational issues, such as significant difficulty in explaining and coordinating the roles and duties of all the institutions, governance structures, and stakeholders engaged in the value chain of climate services. For this, some initiatives including the Intra-ACP CLIMSA project are developing the guidelines that constitute a NFCWWS BluePrint to guide the process of the development of the Frameworks, providing the critical building blocks of a framework, templates and tools. The global best practices – the BluePrint – will provide the Member States with a structured and standardized approach to developing Frameworks, enabling the Member States to develop credible and robust Frameworks in line with WMO standards.

BluePrint is a novel way to streamline, structure, and unify the creation of frameworks for NMHSs and implementing institutions. It serves as a guideline for the NFCWS Framework development process, offering the key building components of a framework, models, and tools (Figure 1). It also offers Member States an organized and uniform method for building Frameworks, allowing them to create legitimate and versatile Frameworks following WMO standards. The Advantages of the blueprint include, but not limited to, the provision of: (i) structured approach for the development of Frameworks; (ii) checklist to guide adequacy of Frameworks; (iii) ease development of the Framework by NMHSs/championing institutions; (iv) benchmarked models for governance structures and institutional arrangements; (v) options for the integration of the NSPs with the Frameworks; and (vi) standardized approach globally for developing Frameworks.

In the proposed NFWWCS governance structures, WMO is proposed to provide technical, capacity building and financial support to the NFWWCS hosting/coordinating body while the oversight institution/body provides oversight role on the development, implementation, and

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<sup>5</sup> <https://public.wmo.int/en/our-mandate/what-we-do>

<sup>6</sup> <https://gfcs.wmo.int/step-by-step-guidelines-nfcs>

operationalization of the NFWCS and provides broader political support and buy-in. The host Institution/Body (e.g., dealing with Meteorology, Climate Change or Disaster Management) will drive the development, implementation, and operationalization of the NFWCS by providing the coordination of weather, water and climate services nationally into a central platform and brings about collaborative climate-related research, monitoring, modelling and prediction capability at a national level. The National Supporting Institutions/Bodies that primarily include Water, agriculture, health, energy, Disaster Management Institutions, Sector Departments/Secretariats/Ministries, etc will support the host institution. Moreover, the roles and responsibilities of collaborating institutions/organizations such as research institutions, academic institutions, NGOs, CBO, private institutions and others shall be defined. The overall coordination between users and producers provides user-driven and user-relevant weather, water and climate services to enable better preparedness to climate change risks. The establishment of sector specific Users Interface Platforms (UIPs) is proposed to strengthen the collaboration between users, producers and key stakeholders.

Box 1. Common challenges identified from various consultative process to update the NFCS framework can be summarized into six major areas such as Governance and Institutional Arrangements; Coordination, Engagements and User-Platform; Structured Development Processes and Knowledge; Support/National legislation gaps; Policy Mainstreaming and Other strategic enabling factors

Inputs from the consultative process undertaken during the process of updating the protocols of the Framework include:

**(i) Governance and Institutional Arrangements**

- There is a lack of viable governance and conceptualization of frameworks to spur the Frameworks' development and implementation.
- Recognize appropriate institutions at the national and regional level to offer supervision, host, and execute the Frameworks. – Oversight/coordination from a high-level ministry or institution is required.
- Institutional models for Framework Implementation

**(ii) Coordination, Engagements and User-Platform**

- There is a lack of engagement between the user and the producer.
- Inadequate credibility in coordinating models, roles, and duties.
- NMHSs, ministries, and other collaborating institutions do not have strong relationships.
- Inability to develop a user-driven framework due to a lack of a trustworthy, dependable, and strong User Platform.

**(iii) Structured Development Processes and Knowledge**

- Member nations must comprehend the WMO-compliant Framework's basic building components.
- There is little or no integration between the NSP and the Frameworks.
- The WMO standard methodology (step-by-step recommendations) must be improved and broadened to encompass the value chain holistically.
- Lack of a systematic strategy for producing Framework implementation plans and costing models under the GFCS IP.
- Member nations have little expertise and capacity.
- NMHSs have insufficient institutional capacity.

**(iv) Political Support/National legislation gaps**

- Weak political backing, as well as the absence of the Framework in national budgetary procedures.
- There are no legal provisions at the national level to support Framework governance, organization, advancement, financing, and implementation.

- There is a lack of coordination among producers, and there is no defined ownership model for products and services.
- Intellectual ownership of data as well as product and service competitiveness

**(v) Policy Mainstreaming**

- Policy Mainstreaming: There is no coordination between Framework development initiatives and National Adaption Plans, as well as growing larger climate change laws and sustainable development plans.
- Alignment model/approach to the National Determined Contributions (Article 4).
- There is a lack of linkage with key regional and national strategies.

**(vi) Other strategic enabling factors**

- Inadequate money to facilitate Framework implementation and operationalization.
- Strategic planning, framework, and action plan must be provided as a One-Time Effort
- Coordination of documentation, tracking, and assessment is lacking.
- There is no framework for integrating national and regional projects.
- Regional support is limited, and there is a lack of vertical and horizontal integration.
- User-driven research is scarce at the national and regional levels.

# NFWCS Blueprint

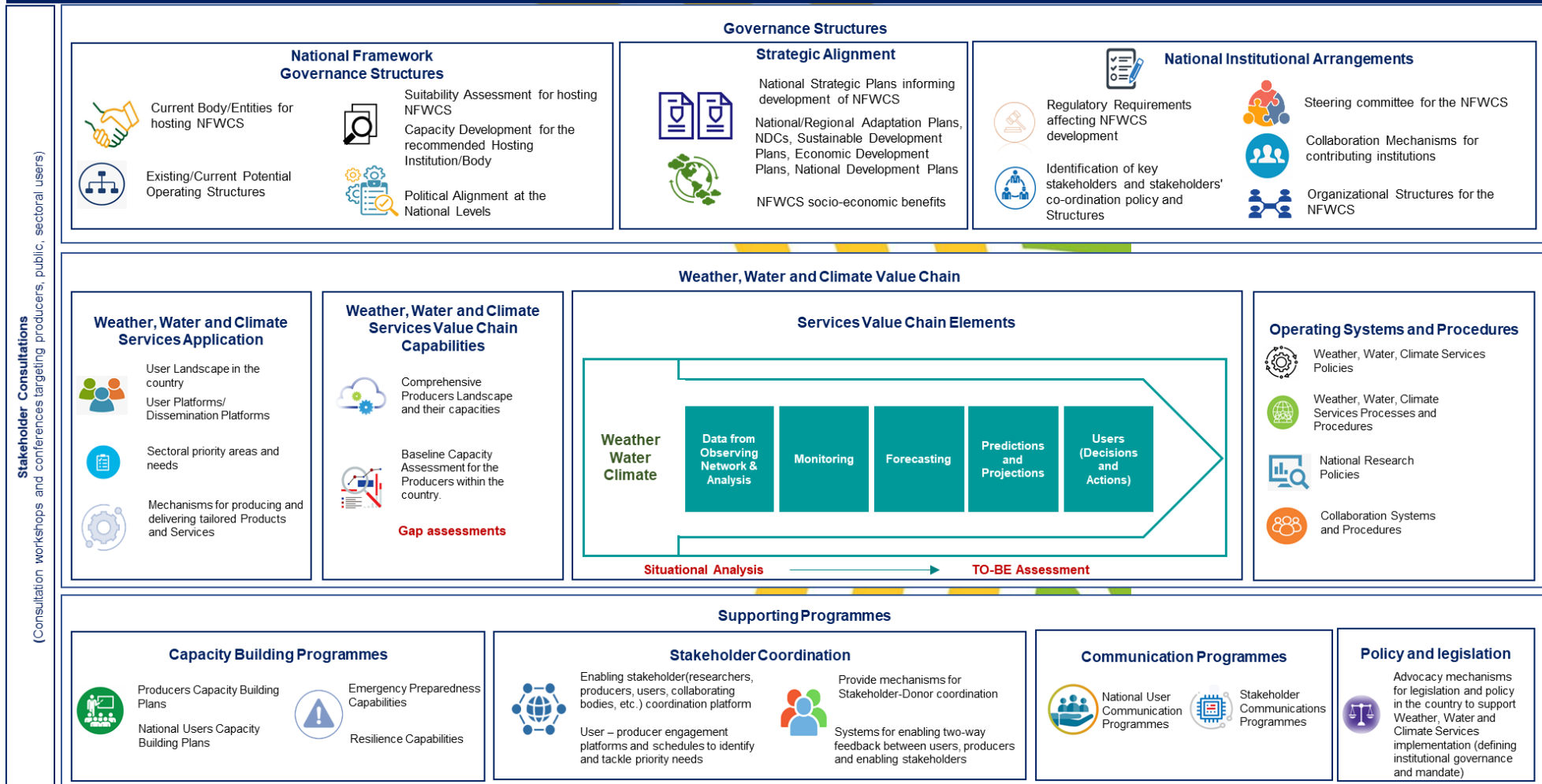


Figure 1: A detailed oriented blueprint of setting up a National Framework of Water, Weather and Climate Services

### 3.2. Regional Climate Services Value Chain in Services Delivery: Opportunities and Challenges

Dr. Amos Makarau began his presentation by saying – the CIS value chain in service delivery can be done at different scales. However, it mainly involves the global producing centers for global data and forecast (e.g. ECMWF, NOAA, UKMO, etc.), regional centers responsible for downscale the data and forecast from the global center (e.g. ICPAC, SADC-CSC, RMSC Pretoria), and NMHSs – who are benefited from the global and regional centres to deliver services to last mile at national and sub-national levels (Figure 2).

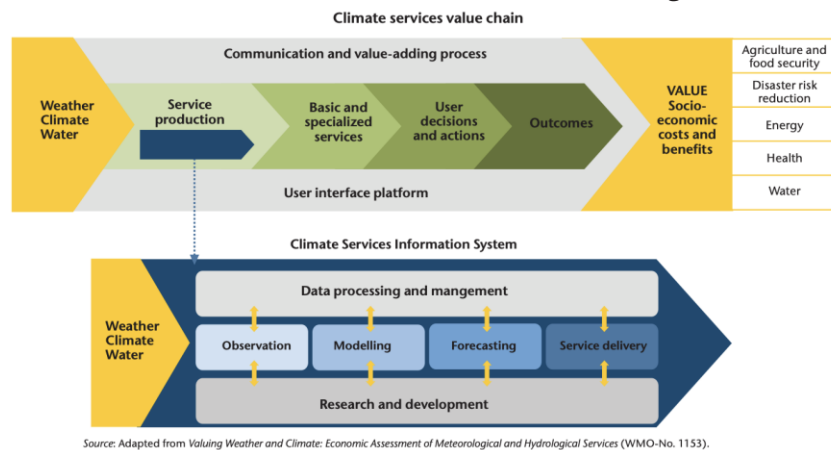


Figure 2. Challenges for production and Services delivery in SADC

Generally, the rate of meteorological, hydrological and early warning services (MHEWS) adoption in Africa is less than in other continents. The study estimated that 60% of the population lacks access to early warning systems that deal with extreme weather conditions and climate change. Hence, more investment in end-to-end multi-hazard early warning systems and climate services is required. More expenditures in climate service dissemination are also needed through various interventions including public-private partnerships to guarantee that climate service dissemination reaches the last mile. The communication networks used for the public delivery of climate services and products in Africa are presented in Figure 3. Accordingly, mainstream media (radio and TV) is the most used platform to access climate services in Region 1 African countries. Email, digital media (Twitter, WhatsApp, and Facebook) and published media are also go hand in hand in the dissemination of climate information. The mobile phone application is the least used method in disseminating climate information despite most Region 1 African countries having access to a 2G network.

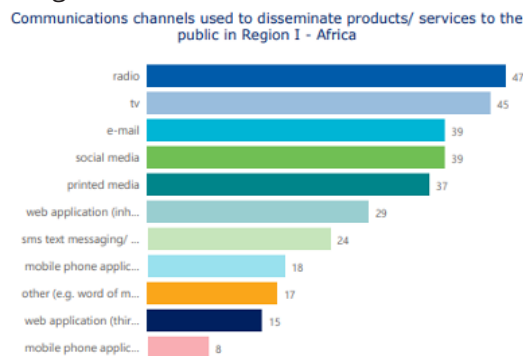


Figure 3: Entities used to distribute climate information services and products ranked

Some of the challenges in Africa to enhance the quality of climate products and services for the end users are related to its appropriateness, relevance, readily availability, reliability, trustworthiness and being not simple and straight to the point. However, there are opportunities to improve service delivery in Africa including the emergence of public-private partnership in technology and telecommunications businesses and existence of strong and sustained collaborations between different actors such as the NMHSs, the commercial sector, and the media. Moreover, some funding is being allocated to new technology, communication, online marketing, and

multimedia creation while efforts to promote collaboration with radio outlets in the region, climate-reporting training for journalists (Radio is the main media to reach the last mile in Africa) are put in-place.

### 3.3. The Importance of CIS in NDC Revision and Implementation: From a Policy Perspective

Dr. James Murombedzi, chief of the African Climate Policy Centre, presented the importance of CIS in NDC revision and implementation. He said that development strategies and plans in most African countries are not adequately informed by climate science mainly due to the limited availability of reliable, useful and useable climate data and climate information services produced by National Meteorological and Hydrological Services (NMHS) and research institutions. The revision and implementation of Nationally Determined Contributions (NDCs) under the Paris Agreement, for instance, require substantive uptake and use of CIS to adapt to climate change and mitigate national emissions. The available carbon budget to accomplish 1.5°C is modest and susceptible to significant uncertainty (AR 6 WG1). The committee projected a residual carbon budget of 500Gt CO<sub>2</sub> from the start of 2020, for a 50% likelihood of keeping under 1.5°C, and 400Gt CO<sub>2</sub> for a 66% possibility. To accomplish 1.5°C and below, very strict mitigation of GHG emissions until 2030 is currently essential, as is net zero CO<sub>2</sub> by 2050.

Meeting the Paris Agreement Temperature Goal may become impossible if NDCs do not increase 2030 emissions reduction objectives. Climate services are critical if we are to limit global temperature increase to 1.5°C. Hence, the NDCs are the first step in bringing climate services to the countries that need those most. The GFCS website<sup>7</sup> also confirmed that the NDCs support the Paris Agreement, which aims to strengthen the global response to the threat of climate change, by ensuring the availability of science-based research and systematic observations for decision-making.

As a mechanism, the NDCs support the Paris Agreement, through the provision of climate services for climate vulnerabilities assessment; targeting of adaptation interventions whilst enhancing adaptation planning and implementation in climate-sensitive sectors. NDCs also complement National Adaptation Plans (NAPs) by providing climate services that help in assessing climate vulnerabilities, identifying adaptation options, developing products that help improve the understanding of climate and its impacts, and enhancing the adaptation planning and implementing capacity of climate-sensitive sectors. An effective CIS requires accesses to reliable information about current and future climate, climate change impacts and consequences and the options for reducing risks or adapting by range of decision makers, stakeholders and users at national and local levels.

The CIS has numerous importance in the NDC revision and implementation including in:

1. *Monitoring Reporting and Verification* (since MRV methods are required in providing relevant information within GHG inventories)
2. *Mitigation* (lowering emissions is one of the indicators for adherence to the NDC)
3. *Adaptation* (managing extreme weather conditions and patterns are critical to the long-term viability and resilience of climatic systems). Adaptation is the priority for the continent, with agriculture, energy and forestry as the key sectors. Hence, more CIS for these sectors are needed.
4. *Governance* (laws and regulatory frameworks must be influenced by big data).
5. *Finance*: particularly considering the provisions in Article 6 for carbon trading.

Overall, the development and implementation of the NDCs help countries who are part of the Paris agreement to prepare, maintain and communicate their NDCs and curb the impacts of climate change on climate sensitive sectors.

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<sup>7</sup> <https://gfcs.wmo.int/sites/default/files/NDCs-Factsheet.pdf>

## 4. Status of NFCS in selected SADC countries

### 4.1. Botswana

Mr. Charles Molongwane from the Botswana Department of Meteorological Services (BDMS) presented about the state of development of NFCS in Botswana. He stated that the BDMS Climatology Division is mandated with managing information and climate data, conducting data processing, climate forecasting, and providing advisory services for sustainable benefit, which includes planning and policy formulation on climate resilience. BDMS has a network of eighteen (18) synoptic Stations that are operational. This includes four (4) airports station -P. G Matante, Maum, Kasane and Sir Seretse Khama International Airport. Additionally, BDMS operates over twenty (20) automatic weather stations (AWSS) as part of its observational network to improve its meteorological value chain, the Departmental continually strives to fulfil its vision of "A modern weather service that nurtures and harbours innovation and creativity in the provision of quality weather and climate information". Climate change and variability are increasing extreme climate events and therefore necessitate the integration of climate information into plans and decision-making. This has increased the demand for climate information and services by a wide range of users.

BDMS in partnership with SADC CSC is to develop a concept note for Botswana's NFSC that will be forwarded to the weather and climate information services (WISER) -the UK met office for vetting and potential funding. The WISER program seeks to improve the development and application of co-produced weather and climate services to aid in decision-making locally, nationally, and regionally, thus further increasing resilience to the effects of climate change. The funds will be used to hire experts to create a climate service model for Botswana, as well as to facilitate capacity building and staff development workshops. Hence, according to the GFCS step-by-step guideline, the country is at stage zero in the development and implementation of the NFCS.

BDMS provides climate services and products such as:

1. Agro-Met Section  
Develop meteorological applications on agriculture to address concerns such as the effects of meteorological elements on arable agriculture, livestock, pests and diseases
2. Climate Section  
Analyse climate data to depict trends, produce climate normal, develop Climatological Products and provides climate information, climate foresight and advisory services.
3. Hydro-Met Section  
Provides meteorological advice and data that is used in planning, monitoring, and management of water resources.
4. Data and Information Management  
Meteorological and climate data is captured, processed, and stored. Keeps the national meteorological data archive up to date. The information is accessible to all end-users.

Objectives for the development of Botswana's NFCS in partnership with SADC CSC are, among others, to develop user-tailored climate information and climate services; to ensure that climate information services are easily available and delivered promptly; to strengthen partnerships and collaboration with government and non-government institutions; to improve the utility of climate information and services including mainstreaming into decision-making; and to reduce vulnerability to climate-related hazards through better provision of climate information and services. The BDMS believed that the establishment of the NFCS would benefit itself as well as its national partners in climate service co-production and implementation. Climate services continue to be integrated into policies and decision-making processes in Botswana, as they are in other nations globally. As a result, the NFCS will play an important role in defining policies and recommendations to help mitigate the risks and opportunities linked to extreme climatic scenarios.

### 4.2. Zambia

The Zambia Meteorological Department (ZMD) is mandated to produce and disseminate weather and climatic information to the aviation, agriculture and other sectors in order to facilitate informed decision-making. Mr. Sinachikupo Kenneth said that the Department performs the following specific functions such as generating and



disseminating of meteorological information to stakeholders and the Public; establish, upgrade and maintain meteorological stations countrywide; collaborate with various stakeholders on meteorological matters; undertake research in meteorology and related matters; and facilitate the domestication and implementation of international, regional treaties and protocols on meteorology matters (<https://www.mgee.gov.zm/>). The work of the department falls under five divisions: Forecasting and Research, Climatology and Advisory Services, Planning and Development, instruments and Administration.

The responsibilities of a National Service are not confined to providing information on present and future weather. Such a service is also required to maintain records of past weather (climatic record) over as long a period as possible in a systematic and orderly manner. The database is the basis for all weather and climate forecasts, products and information, in support of risk and vulnerability assessments, research, design, planning, policy formulation and application to all. Consequently, the database created at ZMD in the late 1980s through the support of the WMO many requests for data or products are now being handled by computer and supplied to a wide range of users. Extracts of data from the computer archives may include: monthly values of climate variables such as rainfall, temperature, sunshine duration, etc; long-term (typically 30 years or more) averages of climate data; and a range of frequently requested data and information, including local climate extremes such as the highest recorded maximum temperature in October at a given location.

The process of developing the NFCWS in Zambia is at initial stage – step 0 to 1. So far, the ZMD initiated virtual discussion with experts from the IRI and South Africa to begin with the process. Moreover, the department sent notification to WMO indicating its intent to begin the process of establishing the Zambia National Framework for Climate Services and made an official request for financial and technical support towards the development and implementation of the NFCS. The AICRRA project has allocated some financial resources to go towards supporting the establishment/development of the Zambia National Framework for Climate Services. The Terms of Reference to recruit the consultant was developed after lessons learnt during a virtual meeting and Zanzibar workshop where the advert was placed in the two local newspapers (Times of Zambia and Zambia daily mail) for 30 days. Currently, the bidder evaluation is underway after the department received letter of interest from five bidders (i.e., local and international). Currently, Zambia has put in place ZMD 5 Project Management Team consists of high-level officials that meet regularly to give high-level policy guidance on NFCS development and implementation. Also, the National steering committee on Climate Change is already put in place where the ZMD, Ministry of Agriculture, Ministry of Water, Ministry of Health, Disaster Management and Mitigation Unit, Environment, Forest and Climate Change Departments and WARMA are members.

### 4.3. Malawi

The Malawi Department of Climate Change and Meteorological Services is responsible for all matters to do with climate change and meteorological services such as climate and weather (<https://www.metmalawi.gov.mw/>). Mr. Clement Boyce said that the Most Common Types of CIS Developed include forecasts (short, medium, and long-term/seasonal), reduced possible climate scenarios, extreme climate and weather warnings (heavy rains, heat waves, tornadoes, floods, dry spells/droughts, squalls, and lightning strikes), application of Agromet services and other customized climate services. The climate service stakeholders in Malawi include the government bodies (Agric, DRM, WRM, Health, Transport, Education, Energy, etc), institutions of higher learning/research as well as NGOs and international NGOs (UNDP, WB, WFP, FAO, MRCS, UNICEF, etc). The department uses various User Interface platforms such as NACOFs, PSP and PICSA, campaigns to raise awareness, mainstream media and digital media (Twitter, WhatsApp, and Facebook) to reach end users.

Table 1. Steps covered in the Development of NFCS

Complete	Ongoing
Evaluating the baseline for climate services	Endorsement of the NFCS's national strategies and implementation plans: <ul style="list-style-type: none"> <li>• Technical pre-validation</li> <li>• Final high-level validation</li> </ul>
A nationwide stakeholder engagement forum on climate services.	Début a National Framework for Climate Services <ul style="list-style-type: none"> <li>• National Event</li> </ul>

Creating a national strategy and implementation plans for the NFCS.	
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Overall, there are multiple challenges that are hindering the development and actualization of NFCS in Malawi. The operational challenges include lack of appropriate observation infrastructure, limited financial resources, and limited human capacity (both in numbers & expertise type). Likewise, the strategic challenges such as lack of understanding of CIS and unavailability of Legal Framework (Act - under development) limited the development of NFCS in Malawi. Consequently, the development of NFCS in Malawi rated as step 3 and the weather and water components will be added. Efforts will be put in place to utilize the existing and potential opportunities that could help the development of NFCS in Malawi by increasing user engagement, improving CIS products, raising awareness of the critical importance of CIS to national economic development, the frequency and scale of extreme weather/climate occurrences have increased, Public-Private Partnership (PPP) and National Met Policy Implementation of District Climate Centres (only 7/28). Lessons learnt, so far, include the benefit of cooperation in the CS value chain and UIPs should be strengthened/established. Tasks related to revision of the proposed NFCS to address weather and water as well as resource mobilization for the process.

#### 4.4. Mozambique

The Mozambique National Institute of Meteorology (Portuguese: Instituto Nacional de Meteorologia de Moçambique) is the national meteorological organization of Mozambique (<https://www.inam.gov.mz/index.php/pt/>). It is responsible for monitoring weather in the country and for providing warning of imminent tropical storms or meteorological changes that could potentially threaten the country. Mr. Jonas Zucule stated that the key sectoral areas focused in the development of the NFWWCS in Mozambique include agriculture and food security; health, energy; water; disaster risk reduction; infrastructures (road); and tourism. This leads to the co-development of a climate information value chain that informs NFWWCS. The co-development is achieved through the partnership between the Meteorological Service department with other government ministries which specialize in water, agriculture, energy, health, infrastructure, and DRR authorities. Collaboration in developing CIS with specified providers is underway through the NCAF where key users and producers stakeholders almost identified and a service provider and user interface platform (UIP) established (Figure 4). The use of exchanging experiences platforms across countries have effectively helped to adopted the NFCS.

The following are identified as challenges and weaknesses in the development and implementation of NFCS in Mozambique including the dearth of governmental legal policies and regulatory rules for significant CIS providers, lack of procedure for mobilizing resources, users have not yet established an integrated platform for co-production (users and suppliers of CIS) and a feedback mechanism for water, weather, and climate information. As a result, the country is at stage zero in its effort to develop the NFCS.

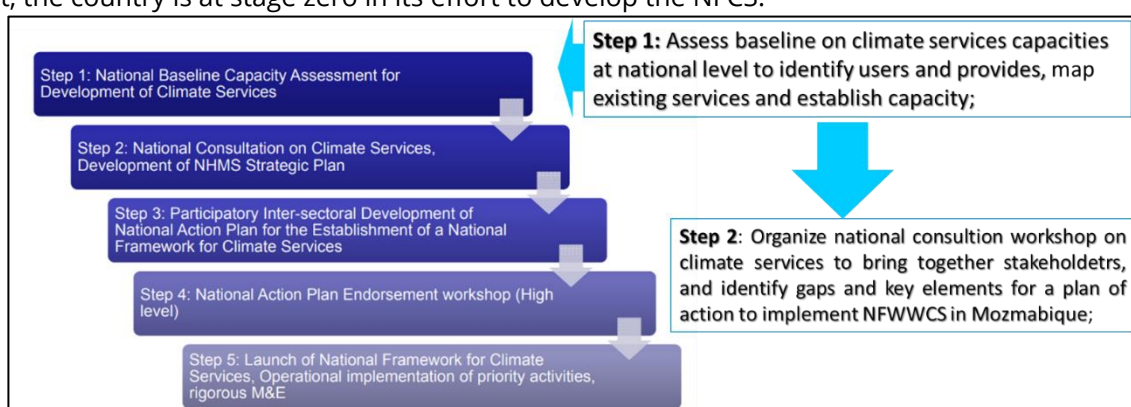


Figure 1: A stepwise approach towards the implementation of NFCS in Mozambique

#### Recommendations and Opportunities

- Some co-production options exist inside the WFP initiative, with an emphasis on collaborating to develop an early warning information system on agriculture and food security.
- Extend and digitize the network of meteorological stations.

- Improves quantitative weather and climate forecasting skills.
- Create a small team to develop a review draft on governance and institutional agreements for the political support and legislation of the NFWWCS rollout.
- Establishing a working group of designated climate information providers, including a committee, to identify gaps and critical features for the action plan for implementing NFWWCS.
- Fundraising for the NFWWCS implementation through financial channels such as the GCF and others.
- Plan a national CIS consultation session to bring stakeholders together and identify gaps and critical aspects for an action plan to implement the NFWWCS.

#### 4.5. Zimbabwe

Zimbabwe's Meteorological Services Department (ZMSD), as the National Designated Authority on meteorology, climate and seismology, contributes to the protection of life and property and science-based informed socio-economic decision-making by providing customer and stakeholder-driven quality meteorological, climatological and seismological products and services (<http://www.msd.org.zw>). It strives to satisfy an increasing need for the delivery of sector-specific weather and climate services and ensures food security, improve water and land management, facilitate disaster risk reduction, and support better health delivery outcomes. Accordingly, Mr. Tamburiro Tecla Pasipangodya, an Agricultural Meteorologist from ZMSD described that the focus of Zimbabwe's NFCS is to strengthen weather observation networks, capacity development, technology transfer, research, policy support, and public relations. With a framework in place, the delivery of climate services will ensure that development is less vulnerable to the adverse impacts of climate change and variability. Most important is the opportunity the framework provides for understanding and addressing the needs of a wide range of users of climate services. More broadly, the NFCS will benefit a wide range of sectors and climate intervention areas, including biodiversity, health, energy, agriculture, human settlements, water etc. Therefore, by implementing the NFCS, the NMHS will be in a strategic position to produce sector-specific products to enable informed decision-making in the context of the effective, efficient and equitable delivery of climate services. A focus on specific sectors will help deliver needed benefits to both providers and users of climate services. The specific sectors of critical focus are as agriculture, health, DRR, energy, water, and natural resources.

So far, several steps taken by different stakeholders in the development of the Zimbabwe National Framework for Weather and Climate Services (ZNFWCS). These include hosting of the regional workshop on the national frameworks (in 2016), identification of the focal points with the Department (in 2019), assigning of National and Alternate Focal Points, as well as sector Focal Points (Agriculture & Food Security, DRR, Water, Energy, Health, Tourism). Activities such as setting up a Technical Working Group (TWG) from ZMSD as the Secretariat, representatives for the six priority sectors (health, water, agriculture & food security, tourism and DRR), government departments and partners to guide the development of the national framework. Draft ToR for the TWG has been developed while subsequent meetings held mostly on adhoc basis.

In 2019, baseline on the current services is done internally by the Zimbabwe Meteorological Services Department with the guidance of the TWG followed by holding the National Consultative workshop held in November 2020 with both technical and financial support from WMO, Zimbabwe Resilience Building Fund (ZRBF), WFP, UNESCO. ZRBF recruited consultant to develop draft strategic and action plan (Work initiated November/December 2021) and this is waiting for validation workshop on the draft strategic and action plan (March 2022). Hence, the country is at stage 3 of the GFCS step-by-step guideline. Once finalized the work of consultant, resource mobilization for further work on the draft framework. However, efforts will be needed to put the strategic and action plan still need to be worked on to meet WMO requirements and attend to comments from colleagues within the region by including the weather and water components into the document and integrating NFCS with policy frameworks such as NAP (Climate Change Management Department).

For the better implementation of the national framework, the following are suggested: expansion of the observation network, procurement and installation of 5 weather radars, procurement and installation of 47 AWS, AWOS, digital stations (Government and partners), improved climate services incorporating the co-production component, partnership, and capacity building of MSD staff are needed.

## 5. Sharing Best Practices FROM the development of NFCS

### 5.1. Ethiopia (NFCS-E)

Dr. Asaminew Teshome from EMI confirmed that the Ethiopia's NFCS (NFCS-E) was established in accordance to the WMO's GFCS guidelines. The goal of NFCS-E is to organize and allow institutions to collaborate in co-designing, co-producing, communicating, delivering, and utilizing Climate Services for decision-making in socioeconomic sectors that are vulnerable to climate change. Five priority sectors such as Agriculture, Water and Energy, Health, Environment, and Disaster Risk Reduction identified for NFCS development. NFCS-E development launched through a consultative workshop with key stakeholders in April 2018 in the presence of a WMO representative. The NFCS-E development process started with the identification of priority sectors followed by establishment of NFCS sectoral task force and the NFCS steering committee. Three important documents namely a baseline study to inform the development of NFCS-E, NFCS-E strategic Plan (2021-2030) and NFCS-E coordination guidelines have also been developed.

The baseline document was developed to identify stakeholders/actors in the national chain of climate service; examine climate services that are currently being provided, needs and gaps; assess capacities of relevant institutions in the country against the five GFCS pillars; and assess and determine the country's state of readiness to implement NFCS. Subsequently, the study identified 48 Woreda in 8 rainfall homogenous zones in the country and consulted key Federal climate service related institutions, Academia, projects professional societies and partners. The core finding are:

- Key economic operations are sensitive or reliant on climate and weather patterns.
- Inadequate decision-relevant policies and procedures that support CIS
- Coordination is loose rather than binding.
- The staff's expertise and knowledge are limited.
- Resources, innovation, and financing for climate services are lacking.
- The quality, timeliness, dependability, adoption, and application of climate data are all constrained. And, users' needs were not fully assessed.

Under the institutional gap analysis, the EMI<sup>8</sup> conducted an environmental scan in priority sectors including within itself. The EMI identified limited weather and climate modelling capacity and research, shortage of experienced staff, lack of staff incentive mechanism, slow growth in instrumentation, calibration and maintenance and ICT capability, and poor coordination among climate service actors as its weakness. Factors such as computational facility (HPC), continuous effort on improving forecast skills, growing partnership, presence of web based UIP (maproom) and increased visibility (by ministries and the public) are among its strength. Similar assessments were also conducted in other sectors.

Under the coordination and governance, the Ethiopia's NFCS institutional procedures are divided into four administrative tiers (i.e., Federal/National level, Regional level, Zonal level and Woreda/District level). The federal NFCS council is chaired by the Deputy Prime Minister and co-chaired by the Minister of the Ministry of Water and Energy. The council is composed of NFCS federal coordination unit and NFCS federal sectoral taskforces. Similar organogram is adopted at regional, zonal and wereda levels. The ten years strategic plan is also developed to provide the groundwork for better coordination, interaction, and action of stakeholders, increase effectiveness of stakeholders in climate services delivery through improved institutional capacity, ensure sustainability of climate services as a result of better ownership, coordination, co-production, knowledge sharing, and meeting of users' needs, and enhance transparency and accountability through the establishment of monitoring, evaluation and reporting frameworks. The country has fulfilled the requirement needed to complete stage 4.

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<sup>8</sup> EMI is mandated to investigate and study the weather and climatic condition of Ethiopia in order to exploit the beneficial effects for economic and social development by collecting analyzing and studying data of atmospheric air. It provides weather forecast and early warnings on the adverse effects of weather and climate of Ethiopia [http://www.ethiomet.gov.et/about/mission\\_vision\\_value](http://www.ethiomet.gov.et/about/mission_vision_value).

## 5.2. South Africa (NFSC-SA)

Ms. Alinah Mthembu, a climate change adaptation expert told to participants that the South Africa’s NFCS (NFSC-SA) has defined clearly its vision, mission and goals and aligned itself with the country’s National Climate Change Adaptation Strategy (NCCAS) and NDCs. The Climate Services chapter of the NCCAS is anchored on the NFCS-SA and provisions are made in the NCCAS for the effective implementation of the NFCS, with the overall goal to develop a coordinated Climate Services system that provides climate products and services for key climate vulnerable sectors and geographic areas. The key strategic outcome for climates services in the NCCAS relates to the development and implementation of climate products and services in South Africa, in order to reduce risks and plan suitable responses. The NFCS-SA identified the CIS providers (Table 2) and users in South Africa. The users include general public, private sectors, media, academic institutions, research institutions, government, and NGOs.

Table 2. Climate services landscape in South Africa

Climate Service landscape docket	Service provider
Observation and monitoring	DWS, DFFE, ARC, SAWS, SANSA, WRC, SAEON
Research, Modelling and prediction	DSI, DALRRD, COGTA, ARC, SAWS, CSIR, CSAG, SARVA, SANBI, SAEON, SAGEIO, WRC, NBI
User Interface Platform	DFFE, DSI, DALGRRD, ARC, SAWS, CSIR, CSAG, SARVA
Climate Services Information System	DFFE, DSI, COGTA, ARC, CSIR, SARVA, SANBI, SAEOS, SAEON, SAGEO, WRC
Capacity Development	DWS, DFFE, COGTA, ARC, SAWS, CSIR, CSAG, WRC

The NFCS-SA put in-place a clear operational Structure to provide strategic direction to the implementation of the NFCS, and assists with data input from their institutions and users may recommend special committees. Moreover, a Roadmap for the Institutional mechanism for the implementation of the NFCS-SA was developed in five phases in Figure 5 below.

Figure 5. Road map for the implementation of NFCS-SA

National Framework for Climate Services will be implemented in 5-Phase approach, to ensure that lessons in early phases can be applied in subsequent phases. This approach will minimize the risk associated with implementation of such a massive project. The phased-out approach is depicted below;				
Phase 1: Establishment of a NFCS Structure	Phase 2: Pilot with SAWS climate data	Phase 3: Interface with government research institutions (i.e. ARC, CSIR and WRC)	Phase 4: Interlink with other institutions (including universities)	Phase 5: Interlink with Regional Climate and Global Centres
This phase comprises of a preparatory phase, that includes recruitment of competent personnel where required, infrastructure, set-up costs and initial operational budget. Most importantly, the Climate Services Portal should be up and running and ready for interfacing. MOUs/MOA signed.	Upon successful Pilot with SAWS, the portal will now be ready to interface with government research institutions. The modelling capability is improved, more resources (human, technical, finance) are required. The NFCS Structure can provide simple customized climate services products and applications.	Upon successful Pilot with SAWS, the portal will now be ready to interface with government research institutions. The high resolution modelling capability is improved, more resources (human, technical, finance) are required. The NFCS Structure can provide simple customized climate services products and applications.	The NFCS Structure is now functional, efficiencies are built in the system. The portal should now allow more service providers to interface with the NFCS Structure. The NFCS Structure can now provide comprehensive climate modelling and research. The NFCS Structure can provide improved customized climate products and applications to various sectors.	The NFCS Structure can now provide comprehensive climate modelling and research. The NFCS Structure can provide advanced customized climate products and applications to various sectors.
<i>That a Business Case has been developed, along with the Operational Plan and Budget for NFCS Structure.</i>	<i>MOU/MOA is signed with SAWS, defining datasets that will be shared with NFCS Structure.</i>	<i>MOUs/MOAs signed with target agencies. Lessons learnt and best practises from Phase 3 are applied to Phase 4.</i>	<i>MOUs/MOAs signed with target agencies. Lessons learnt and best practises from Phase 3 are applied to Phase 4.</i>	<i>MOUs/MOAs signed with target agencies. Lessons learnt and best practises from Phase 4 are applied to Phase 5.</i>

Currently, there are still bilateral talks with climate service providers. This is to make sure that they comply with the terms and conditions required for setting up an information products portal for the end user. The engagements involve the establishment of a series of dialogues that includes the NFCS and UIP phases. Meanwhile, there is research underway on a funding model for observation infrastructure. The NFCS-SA identified main challenges that could hamper its implementation as insufficient resource (human capacity, skills and knowledge, ICT, connectivity, quality data) and others (Table 3).

Table 3. Major gaps and initiatives underway

Gaps	Initiatives underway
Climate information and data platforms	Development of a climate service website that provides best practices and offers information accessible and customized for specific sectors and enhances networking.
Efficient management of climate data system for the country	Collaboration between local academic institutes to develop a data system.
Designing and launching an early warning system	Creating and operationalization of an Integrated Climate-driven Multihazard Early Warning System (ICMHEWS) supported by donor grants.
Depreciating public good weather and climate observation structure	Joint key stakeholders to address key problems and challenges that require solutions
The urge to create a new financial model that is capable to do a national observing network	Fundraising through the World Bank to support the research study on a climate foresight model that is accessible to the public and funds the implementation of the NFCS.
Open access data policy: Data influence and value studies that show the synergies of open access data of Earth System.	Initiate a cooperation agreement that makes data accessible and available to all collaborators.

### Box 2. Lessons learnt and requirements for a successful NFCS-SA

<p><b>Lesson learnt</b></p> <ul style="list-style-type: none"> <li>• Provide essential knowledge on the tradeoffs and synergies derived from the process of creating and implementing the NFCS.</li> <li>• Begin with what is readily available</li> <li>• Start small and with a team before scaling up.</li> <li>• Search for collaborators</li> <li>• Collaborate/Partner with organizations or individuals that push the agenda and do not stall the project from progressing.</li> <li>• Communication is essential between all stakeholders (end users, collaborators etc.).</li> </ul> <p><b>Requirements for a successful NFCS</b></p> <ul style="list-style-type: none"> <li>• Comprehending and focusing on the end users' needs and wants. It should be a bottom-up approach.</li> <li>• Enhanced distribution and communication network</li> <li>• Strong partnerships and collaboration network that creates a paradigm shift</li> <li>• Financial support of models</li> <li>• Investment in modern infrastructure and maintenance</li> <li>• Designing and developing a climate service system that analyses interprets and disseminates climate information services and products</li> </ul>
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## 6. OTHER Related presentations

### 6.1. GFCS Sectoral Exemplars

The GFCS is a multilateral collaboration of the public and private institutes that create as well as use climate data and services by bringing together the government, private entities, researchers, data producers, and users among others to enhance the quantity and quality of climate services globally, especially in developing countries. The widespread and effective uses of CIS by end-users require significant interaction among relevant stakeholders, including government, civil society, communities, partners and donors, decision makers, climate experts and sector disciplines. e platform is based on the requirements of the user in decision-making. Non-climate data, like agricultural productivity, health patterns, demographic distributions in volatile areas, road and infrastructure

maps for goods distribution, and other socioeconomic aspects, are combined with big data products. The goal is to be efficient in risk management and preparedness for anticipated new climatic changes, as well as adapt to the significant effect on water resources, potential health implications, extreme weather events, crop productivity, infrastructure placement, etc.

Well-structured User Interface Platforms (UIPs) that provide climate services, can effectively address users' needs through (i) feedback – a systematic process to gather and analyse needs for CI. Should communicate to all pillars, (ii) dialogue – iterative process to assess needs and develop delivery capabilities. development of new products, (iii) outreach – Advocacy, awareness raising of the usefulness of products, experiences, and (iv) monitoring and evaluation – establish and maintain M & E to ensure effective decision-making. Assess what is working and what is not. Overall, the UIPs have an active engagement phase that has multiple interfaces for user engagements and informing decisions; an intermediate phase and the passive engagement phase.

1. The active engagement phase is tailored and targets focused relationships:
  - Bespoke services
  - More intense interactions
  - Highly iterative
  - Directly usable data
  - One-to-one understanding
2. The intermediate phase is a dialogue based with interactive group activities including:
  - Multi-way communications
  - Building trust
  - Co-learning
  - Capacity building
  - Regular interaction
3. The passive engagement phase provides information using websites and web tools that are:
  - One-stop shop window
  - Up to date
  - Wide range of products
  - Easy to use
  - User-guided design
  - Intuitive

Exemplars of capacity building in agriculture and food security can include seminar training and farmer field schools (Box 3). The national forums and farmer field schools are a knowledge entity for sharing useful information concerning agriculture. It is an alternative way of extension services of educating agricultural users on the decision support tools and products available. To make the centres more efficient, coordinated meetings are held to analyze end-user needs, develop agro-advisories, and review the performance of the goods and services supplied to user communities. CIS successfully reach the farming community through Farmer Field Schools. Nongovernmental Organizations (NGOs) have played an important role in the establishment of telecentres in inaccessible areas, especially in the Least Developed Countries.

### Box 3. Some examples of translating climate information to agricultural use

#### SIMAGRI

- a tool used to support agriculture decision-makers. It improves the efficiency of decision-making and promotes conversations on sustainable production methods, concerns of technology adoption, and the assessment of long-term impacts while considering the interplay of numerous aspects.

#### ASIS (Agricultural Stress Index System)

- ASIS is an early warning system to monitor drought. It is tailored for Ethiopia and was co-developed with FAO's global tool.

#### Crop Capability Prediction Model

- Policymakers and the community gain from the coordinated supply of adequate resource inputs to the agricultural and food security sectors.

#### Hydrological Mappings (MacLeod et al; DOWN2EARTH)

- Using past DRYP runs in conjunction with GHACOF projections. It creates a prediction by resampling tercile hydrological maps and weighing them with the GHACOF tercile probability.
- Utilization of the flood prediction tool by NMA as an early warning system
- In eastern and southern Africa, flash floods are becoming increasingly common. Effective flash flood prediction is critical for early warning systems. It is critical to configure, test, and adjust the model (WRF-hydro in offline and coupled mode) to deal with flash floods. All NMHS workers need to be trained on how to use the flash flood, forecasting model. The model can be used one-way or two-way. When contrasted to uncoupled WRF simulations, the coupled WRF/WRF-Hydro modelling system provided superior rainfall and water scenarios. The utilization of coupled air and water linkage has the potential to enhance rainfall and water predictions for flood monitoring systems.

## 6.2. Leadership and Management in NMHSs for the Generation and Delivery of Climate Service: Challenges and Opportunities

Given the importance of meteorology in so many sectors of the economy, the position of the NMHSs in the institutional framework of the government is critical. A suitable position will aid in the transparency of hydro-meteorological services, allowing government policies to be implemented that will result in long-term capacity growth. Cooperation between NMHS institutions and other stakeholders should be promoted in the development of NFWWCS. The NFWWCS is an institutional structure for regional institution synchronization, unification, cooperation, facilitation, and strengthening of various departments. Concentrating on the five components of the GFCs may enhance the co-production, customization, dissemination, and usage of science-based climate forecasts and services. Many nations either have formed or are in the process of establishing NFWWCSs, which require government mandate through a participative national agency agreement with clearly specified terms of reference and action plans for each of the institutions participating.

The NFWWCS's success relies on a well-integrated and sustainable system of governance. The role of the National Government is critical and major government agencies should be able to have high-level representation in the governance structure. Furthermore, the national government ought to incorporate specialists from relevant subjects and industries into its structural system. Some nations have advanced in NFCS and have formed National Steering Committees that are led by the Presidency. NMHSs act as the NFWWCS Implementation Secretariat and play a critical role in the Framework's implementation at the national, regional, and global levels. The actions of Climate Service Enablers and Climate Service Providers are coordinated by NMHSs. Additionally, NMHSs must collaborate with other organizations at these various levels, to provide coordination for the establishment and operation of climate services at the national level. The Framework's governance structure will help with the following:

- Establish and revise policy agenda, as well as track milestones.
- Assure responsibility for achieving the Framework's vision.
- Make certain that enough professional and technical advice is provided.
- Offer supervision to make certain that resources are utilized wisely.
- Following their duties, promote cooperation among key parties.
- Make financial stability easier.

### Hindrances in Delivering Efficient Leadership

- *Lack of Fostering effective leadership*: it focuses on collaboration, team development, and organizational skills. Specific leadership problems include how to assist, how to collaborate successfully, and what to do while taking up NFWWCS leadership.
- *Effective management of stakeholders* entails managing alliances, having political goodwill, and the Framework's brand. Obtaining managerial support, managing, persuading stakeholders, and



obtaining buy-in from colleagues from different departments, organizations, or people are all examples of this.

- *Efficiency*: This leadership challenge is about learning the necessary abilities, such as time management, prioritizing, strategic thinking, decision-making, and being familiar with the Framework's implementation.
- *The problem of inspiring or motivating stakeholders* to ensure that they grasp what is required of every government entity in the Framework's implementation.

## Opportunities

- *Visionary Leader and Visibility*: NFWWCS should indeed be initiated and directed by NMHSs, as they are the government-mandated suppliers of hydrometeorological services across most countries.
- *Collaboration*: As part of a baseline assessment, the NMHS should engage all relevant national stakeholders involved in the five component pillars of the GFCS, taking stock of national institutions that provide climate-related information as well as major ongoing climate-related programs and activities in the country.
- *Facilitation*: The NMHS ought to conduct and lead a nationwide stakeholders dialogue to design the NFWWCS and its governance structure, as well as to outline a strategy for NFWWCS's effective implementation.
- *Coordination*: A detailed WMO (2018)<sup>1</sup> protocol describes ways to establish, create, support, and debut a functioning NFWWCS that will act as a crucial coordination mechanism and bring together the local, national, regional, and global stakeholders required for the effective generation, tailoring, communication, delivery, communication, and usage of co-designed and co-produced climate services with and for users.

### Box 4. Checklist for a successful framework at the national level

Checklist for a successful framework at the national level includes, but not limited to,

1. Establish a robust institutional foundation for the Framework for Climate Services.
2. Address the need for customized climate service supply in the country's key climate-sensitive sectors (agriculture and food security, health, disaster risk management, construction/infrastructure/transportation, etc.).
3. Increase the ability of the NMHS and other technical services to develop key climate goods and services in collaboration, drawing on transdisciplinary knowledge and skills from each sector.
4. Communicate effectively and dissemination of climate services
5. Broaden channels of communication and transmit using novel outlets (aside from TV)
6. Improve capacity to fulfil end-user demands by modernizing and increasing the density of the NMHS observation network.
7. Promote joint climate research to provide more visible end-user-driven climate research outcomes.
8. Create and boost end-user capacity that will further utilize and adaption of climate services.
9. Maintain at the national level the newly established Framework for Climate Services.

10. Include all national stakeholders that will contribute to the production, interpretation, communication, and usage of climate services in a national discussion to identify country requirements and plan a course for the provision of user-tailored climate services at all levels.

## 7. Breakout session

Participants discussed what lessons did they learn from Ethiopia and South Africa on stakeholder mapping, user interface platform analysis and gap analysis to customize them to their respective countries. Box 5 summarized the outcomes from breakout session followed by general discussion.

Box 5. Lessons learnt, major challenges and opportunities identified from the breakout session.

### **Lessons Learnt – need for:**

- Stakeholder mapping. Thus, holding a consultative workshop to identify the stakeholders & enhance partnerships should be done to identify stakeholders and form an interim steering committee.
- User interface platform- Have a bi-direction User Interface Platform (information is given to users and users provide feedback).
- Gap analysis - Assess capacities (strengths and weakness) of key sectors. What needs to be assessed include infrastructure, service delivery and Coordination mechanism
- Working with the existing structure: while improving on them as you progress, get the basic structure right and take little at a time.
- Collaboration and partnership:
- Aligning NFCS with development policy and plans: The framework should be aligned to existing legislation and policy strategy and other strategies

### **Major challenges**

- Having Government buy-in or political approval
- Many Projects (NAP, NDC & NFCS) running at the same capacity to undertake all these at the same – Botswana
- Securing finances for the development of NFCS
- How to ensure effective and sustained participation at the right hierarchy level since the inception phase
- Inadequate infrastructure network of observatory stations coupled with trained personnel.
- Lack of adequate leadership in driving this process.

### **Opportunities**

- Leverage on WMO and regional climate center's support.
- Countries have the right capabilities/expertise
- Extreme weather events and associated impacts necessitate the need for countries to develop the NFCS.
- There is a call from the UN General Secretary for the implementation of early warning systems for the next five years in Africa.
- Inclusion of water in NFCS.
- Continuous engagement with countries at advanced stages (e.g. Ethiopia and South Africa)
- Use of virtual platforms
- Understanding our own landscape (capacities within institutions)
- Regional approach to address some of the challenges in capacities (NWP, radar technology).

## 8. Recommendations

The general consensuses and recommendations going forward from the workshop participants are captured below following a brainstorming session, which was conducted at the tail-end of the workshop. The purpose of the session was to chart a course for the next key and important processes that needs to take place in the Southern Africa region:

- *Strengthen regional supports and collaboration* to assist countries that have already started to complete the process in the development of the framework. Countries must leverage on already developed National frameworks such as Ethiopia and South Africa to customize and develop their own frameworks
- *Align the NFCS with the national strategic plans* such as NDC, NAPs and others and able to provide quality and timely climate services for climate vulnerable communities and implementation of adaptation interventions in climate-sensitive sectors.
- *Capitalize on the existing public-private partnership* to produce their own NFCS to be able to properly benefit from public and private sector programmes and initiatives.
- There was an urgent need to bring about *effective governance model* to enable the successful development and implementation of the NFWWCSs. The governance model should comprise of ministries or entities that has political powers to influence ministerial and stakeholders' collaboration at National level, represented by key decision makers.
- NHMS should *create awareness about the NFCS and engage relevant stakeholders*. It shall also start sourcing for funding and needs to be proactive to initiate the establishment of the NFCS process.
- *Political and government buy-in* is of paramount importance to the successful development of the Framework. Political buy-in and government leadership support will assist propel the development and implementation of the Framework. Support from high level authorities will catalyze coordination of contributing ministries and entities. Furthermore, soliciting of funding and inclusion of NFWWCS funding in the treasury funding bills will be possible.
- *Dispatching the new guidelines* for the development of NFWWCS to the countries and to the region to smoothen and enrich the process for developing the NFWWCS in line with WMO requirements, and assist in building proper governance models, intuitional arrangement models, and articulate the key Framework development steps.
- *Develop Regional Framework for Weather, Water and Climate Services* to provide for regional based programmes, in particular programmes such as regional based resource mobilization and user-driven research. This framework could be utilized as a strategic instrument to accelerate the implementation of NFWWCSs across all Southern Africa countries.
- *Engage decision makers* in the planning, critical workshops, launching and endorsement of the Frameworks. The role and importance of the Framework and the broader socio-economic benefits over and above adaptive capacities should be well articulated to decision makers.
- *Provide responsibility to leaders and senior government staff members* in the Southern Africa countries through the appropriate government structures to champion, support or enable the development of the Frameworks, as it is done with other plans such as adaptation plans. Furthermore, the leaders in the countries should be held accountable for the planning and implementation of the Framework.
- *Continue a south-south learning and knowledge sharing mechanism* through AICCRA and regional initiatives that aims at the co-development of NFCS in the SADC as well as other sub-regions.
- *Develop a template and share* among the participating countries (*attached in section 9*).

## 9. Template for the Development and Implementation of NFWWCS Action Plan in NMHS

A simple Action Plan focuses on “What”, “Who” and “When” the development and implementation of NFWWCS would be undertaken in the NMHS. This template is developed to request directors of the NMHSs concerning the development the National Framework for Weather, Water and Climate Services (NFWWCS) as agreed during the workshop. Specifically, the template requested countries to produce an action plan of a maximum of five (5) pages that will help to further develop their NFWWCS and solicit for support from the workshop organizing institutions (AICCRA-ESA, ACPC, WMO-RoA) and beyond.

1. What is considered here are the weather- and climate-driven problems on which the NFWWCS would revolve. Identify all weather and climate-driven problems encountered in the country that climate services, at all timescales, could play a role in resolving:
  - Hazards (civil protection/disaster prevention):
  - Diseases and epidemics sensitive to weather/climate (health):
  - Food security (agriculture, livestock and fisheries):
  - Water resources:
  - Other key sectors affected by weather/climate variability and change
2. Who will be involved in the development and Implementation of NFWWCS? Identify stakeholders working on each problem (potential actors in the production and communication of climate services across the information chain), at all levels of decision-making from national to community levels:
  - Who are the key stakeholders already mandated to provide weather/climate information and or climate services to vulnerable communities?
  - Who is making use of the information/services, and whose task could be improved with climate information/services?
  - Who has a potential interest in utilizing climate services?
  - Who are the critical decision-makers/institutions to invite to the discussion table, in order to establish a National Framework for Weather, Water and Climate Services (NFWWCS)?
  - Other decision-makers of highest political rank (to anchor the process)
3. When do you want to take proactive steps to develop and implement the NFWWCS
  - Agreeing on a time frame for action
  - Identifying resources (human, financial and technical)
  - Expected outcomes
4. Key issues to consider:
  - Requisite processes to enable information flow from the NMHS to relevant institutions (for example, a memorandum of understanding) for the provision of salient climate services to vulnerable communities
  - Define an appropriate institutional framework for climate service provision and clarify institutional mandates by determining:
    - o Who is in charge of producing the information
    - o Who is in charge of interpreting and packaging the information for target end users (climate service production – all partners in this endeavour)
    - o How the chain of information works
  - Firmly place the NMHS at the centre of development of the NFWWCS by:
    - o Consensually agreeing to define an appropriate institutional framework for the NFWWCS
    - o Establishing an NFWWCS, starting with the NMHS and ending with the vulnerable communities as end users
  - Is there a process for integrating climate information services into relevant national and sectoral policies, strategies and plans such as NAP, NDC, etc?

## 10. Agenda

Time	Activities	Responsibility	Chair
<b>DAY 1 – 28 Sept. 2022</b>			
<b>Session 1 - Opening</b>			
09:00 – 09:30	Registration	AICCRA Team	
09:30 – 09:35	Welcoming Remarks	Dr. Jonas Mphepya (SAWS)	Dr. Dawit Solomon (AICCRA-ESA)
09:35 – 09:50	Introduction of participants	Participants	
09:50 – 10:00	Opening remarks	Dr. Amos Makarau (WMO ROA)	
<b>Session 2 – Setting the Scene</b>			
10:00 – 10:30	Guidelines for the development of the National Frameworks for Weather, Water and Climate Services	Mr. Mabu Mamadi (South Africa)	
10:30 – 11:00	Discussion		
11:00 – 11:30	Tea/Coffee and Group Photo	AICCRA Team	
11:30 – 12:00	Importance of CIS in NDC revision and implementation: From a policy perspective	Dr. James Murombedzi (ACPC-UNECA)	Dr. Teferi Dejene (AICCRA ESA)
12:00 – 12:30	Regional climate value chain in service delivery: Opportunities and challenges	Dr. Amos Makarau (WMO ROA)	
12:30 – 13:00	Discussion	Participants	
13:00 – 14:30	Lunch	AICCRA Team	
<b>Session 3 - Country Status Presentations</b>			
14:30 – 16:00	Status presentations on the development of NFCS: <ul style="list-style-type: none"> <li>• Zimbabwe</li> <li>• Botswana</li> <li>• Mozambique</li> <li>• Malawi</li> <li>• Zambia</li> </ul>	NFCS focal point from each country	Dr. Ernest Afiesimama (WMO-ROA)
16:00 – 16:30	Discussion	All Participants	
16:30 –	Tea/Coffee	AICCRA Team	
<b>DAY 2 – 29 Sept. 2022</b>			
<b>Session 4 – Sharing Best Practices</b>			
09:00 – 10:00	Best practices and lessons learned in the development of NFCS: <ul style="list-style-type: none"> <li>• Ethiopia</li> <li>• South Africa</li> </ul>	Representatives	Mr. Mabu Mamadi (South Africa)
10:00 – 10:30	Q & A	All Participants	
10:30 – 11:00	Coffee/Tea	AICCRA Team	
<b>Session 5 – Breakout Session</b>			
11:00 – 13:00	Discussion topics include: <ul style="list-style-type: none"> <li>— What <b>lessons have you learnt</b> from Ethiopia and South Africa on stakeholder mapping, user interface platform analysis and gap analysis that can be customized to your respective countries?</li> <li>— What are the major <b>challenges</b> and <b>opportunities</b> related to the development and implementation of NFCS in your country?</li> <li>— What do you <b>recommend</b> for enhanced development and</li> </ul>	Zimbabwe Zambia WMO  Malawi Mozambique Botswana	Ethiopia PR  South Africa PR

	implementation of NFCS at the national and regional level		
13:00 – 14:30	Lunch	AICCRA team	
14:30 – 15:30	Report back	Group members	Dr. Calistus Wachana (ICPAC)
15:30 – 16:30	General Discussion	All participants	
16:30 –	Coffee/Tea	AICCRA Team	
<b>DAY 3 – 30 Sept. 2022</b>			
<b>Session 6 - Capacity Building</b>			
09:30 – 09:50	GFCS sectoral exemplars (Agriculture and food security)	Dr. Yosef Amha (AICCRA)	Mr. Mabu Mamadi (South Africa)
09:50 – 10:10	Leadership and management in NMHSs for the generation and delivery of climate Service: Challenges and Opportunities	Dr. Ernest Afiesimama (WMO ROA)	
10:10 – 10:45	Discussion		
10:45 – 11:15	Coffee/Tea		
<b>Session 7 - Concrete road-map</b>			
11:15 – 12:45	Concrete measures and next steps to be taken/developed at the country level This session should develop, among others, a roadmap on: <ul style="list-style-type: none"> <li>– What are the key elements to be focused on to finalize NFCS?</li> <li>– Road map on time needed and who are responsible bodies to do what?</li> <li>– How to mobilize resources for NFCS?</li> <li>– Recommendations to relevant stakeholders</li> </ul>	All Participants	Dr. Amos Makarau (WMO ROA)
12:45 – 13:00	Vote of thanks	Dr Jonas Mphepya Dr. Dawit Solomon	

## 11. List of Participants

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# AICCRA

Accelerating Impacts of CGIAR  
Climate Research for Africa



## About AICCRA

Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) is a project that helps deliver a climate-smart African future driven by science and innovation in agriculture.

It is led by the Alliance of Bioversity International and CIAT and supported by a grant from the International Development Association (IDA) of the World Bank.

Discover more at [aiccra.cgiar.org](http://aiccra.cgiar.org)

AICCRA Eastern and Southern Africa is led and hosted by OneCGIAR centers:

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AICCRA is supported by the International Development Association of the World Bank:



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