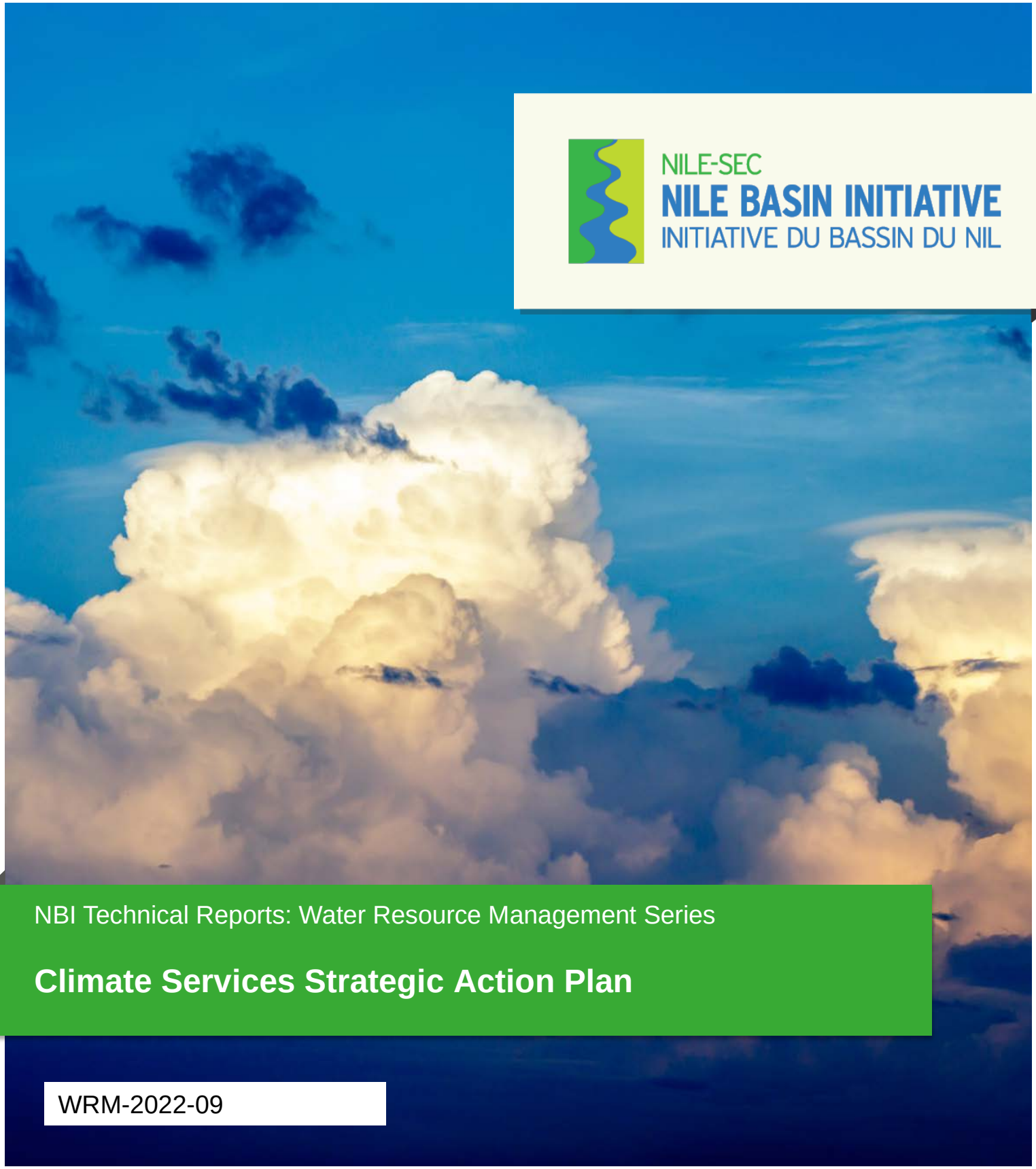

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NBI Technical Reports: Water Resource Management Series

Climate Services Strategic Action Plan

WRM-2022-09

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Document Sheet

This Technical Report series publishes results of work that has been commissioned by the member states through the three NBI Centers (Secretariat based in Entebbe- Uganda, the Eastern Nile Technical Regional Office based in Addis Ababa - Ethiopia and the Nile Equatorial Lakes Subsidiary Action Program Coordination Unit based in Kigali - Rwanda. The content there-in has been reviewed and validated by the Member States through the Technical Advisory Committee and/or regional expert working groups appointed by the respective Technical Advisory Committees.

The purpose of the technical report series is to support informed stakeholder dialogue and decision making in order to achieve sustainable socio-economic development through equitable utilization of, and benefit from, the shared Nile Basin water resources.

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EXECUTIVE SUMMARY

The Nile Basin Initiative approved in 2013 its Climate Change Strategy (CCS) with the overall goal to strengthen basin – wide resilience to climate change and ensure climate compatible water resource management and development.

One way of implementing the (CCS) is through the development of a Climate Services Strategic Action Plan (CS-SAP) and its Work Plan Manual; these have been preceded by the completed Climate Services Catalogue (CSC). The CS-SAP, which has been developed on the guidance of the CSC, considers the current state of knowledge of each product within the CSC and shows opportunities for implementation while bridging the gaps within the Climate Services (CS) Value-Chain. The CS-SAP has been developed as a strategic document that proposes overarching activities to cover different dimensions of climate services that are either technical, service oriented or institutional (e.g. dealing with: data, monitoring, information, interfaces, capacities, policy, etc.) across different disciplines (e.g. hydrology, meteorology, human resources, engineering, information technology, etc.). Therefore this CS-SAP, which comprises of mostly activities common and overarching to the different climate services from the catalogue, will need to be further developed into operational action and work plans where each (or group of) product(s) or services will need their own action plans specific to the different dimensions or discipline of the products and services within the CSC. This should be done through different work packages in the future.

Currently, the CSC has ten (10) climate service products which are readily available and in use while another three (3) are either under development or planned. These products do fall under the following categories: i) core module services; ii) customized climate information products; and services products and procedures.

For each Climate Service product type this CS-SAP proposes the following recommendations:

- Core module services (raw data, tools and data management systems) available for the collection of climate & hydrological data from monitoring and observation network of the National Hydrological and Meteorological Services (NHMS) within the region: Examples of what the CS-SAP suggests in this case are (improving) cooperation agreements for accessing and sharing of data, working on joint programs to increase hydro-meteorological station density and coverage, inventory of current data and related services e.g. customizing the said data towards specific industry needs, etc.

- Customized climate information products: Activities are proposed that optimize the full use of the "Climate Service Catalogue" (CSC) products and services beyond their current use and also widening their scope of use. Similarly, examples of activities proposed are to increase their reliability and performance, increasing the capabilities for customization of climate data and services to different user groups and locations, and tailoring the information for other specific applications and multipurpose use, etc.

- It is further proposed to develop a Climate Service Workflow Manual that is detailing operating procedures within the NBI institutional framework to respond to user needs for climate services. It also does note that by creating a permanent position of a climate services expert or expanding on an existing role of a current member of staff will further the cause of improving CS at the NBI.

- Service products and procedures: Fostering an increase in the specific and customized application of products to different user groups, locations while also suggesting multipurpose uses. These include activities that urge the increase and improvement in usage and transfer of services, building of capacity at the NBI and related regional entities; all this with the final aim of increased outreach and eventual use by interested parties of NBI products and services for the benefit of the entire population within the basin.

Going forward, the NBI will need to address challenges of resources such as finances, time, capacity and manpower for effective implementation of the CS-SAP (and the eventual operational action plans specific to each product and services in the CSC); some of which are proposed through steps suggested in the CS-Work Plan Manual. It is also recommended that better cooperation with NMHS and regional/international organizations such as ICPAC, WMO, GHACOF, etc. to leverage on data, equipment, products and service sharing should reduce costs, improve products and services while helping in acquiring of more funds and the continuously building of CS capacities at the NBI.

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List of Abbreviations

AP	Auxiliary Product
BMU	Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany
CC	Climate Change
CS	Climate Services
CS-SAP	Climate Services Action Plan
CSC	Climate Services Catalogue
CSI	Climate Services for Infrastructure Investments
DWD	German Weather Service
DSS	Decision Support Service
e-Flows	Environmental Flows
ENTRO	Eastern Nile Technical Regional Office
FRM	Flood Risk Management
GHACOF	Greater Horn of African Climate Outlook Forum
GIZ	German Development Cooperation
IGAD	Inter-Governmental Agency on Development
ICPAC	IGAD Climate Prediction and Application Center
IKI	International Climate Initiative
IKP	Integrated Knowledge Portal
NBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NGO	Non-Governmental Organization
NHMS	National Hydrological and Meteorological Services
Nile-COM	Nile Council of Ministers
Nile-SEC	Nile Secretariat
PIEVC	Public Infrastructure Engineering Vulnerability Committee
SPRC	Source-Pathway-Receptor-Consequence
ToR	Terms of Reference
RKH	Regional Knowledge Hub
UN	United Nations
WMO	World Meteorological Organization
WRI	Water Resources Institute (Uganda)

1. Rationale

1.1 A brief about the NBI

The Nile Basin Initiative (NBI) is a regional intergovernmental partnership of 10 Nile Basin countries, namely Burundi, DR Congo, Egypt, Ethiopia, Kenya, Rwanda, South Sudan, The Sudan, Tanzania, and Uganda. It was established on 22 February 1999, by Ministers in charge of Water Affairs in the Nile Basin countries to work towards a Shared Vision Objective: To achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources". The shared belief is that countries can achieve better outcomes for all the peoples of the Basin through cooperation. At the heart of this challenge is the imperative to eradicate poverty.

NBI provides the Member States with the only basin wide and impartial platform to discuss with trust and confidence how to jointly take care of and utilize the shared Nile Basin water resources for win-win socio-economic benefits and to promote regional peace and security.

The Nile Council of Ministers (Nile-COM) of Water Affairs in the NBI Member States is the highest decision-making body and provides policy guidance to the NBI. The Nile Technical Advisory Committee (Nile-TAC), comprising technical representatives from the partner states offers technical support and advice to the Nile-COM on matters related to the management and development of the common Nile Basin water resources.

Professional day to day management of the NBI is by three centers namely a regional Secretariat, the Nile Basin Initiative Secretariat (Nile-SEC) located in Entebbe, Uganda; the Eastern Nile Technical Regional Office (ENTRO) based in Addis Ababa, Ethiopia, and the Nile Equatorial Lakes Subsidiary Action Program Coordination Unit (NELSAP-CU) based in Kigali, Rwanda. In each country, the National NBI Office headed by the respective Nile-TAC member serves as the focal point for all NBI-related activities.

To achieve the Shared Vision Objective, NBI implements three core functions:

Facilitating Basin Cooperation: This function is undertaken to provide a common platform for countries to engage, consult and deliberate with each other and other Nile stakeholders on a regular basis. It aims to build broad political and civic support for transboundary water cooperation in the basin.

Water Resource Management: This function provides critical services in building basin wide technical competencies and capabilities and supporting science/knowledge-based decision making to monitoring, protecting, and sustaining the Nile water resources.

Water Resources Development: This function mainly focuses on identification and preparation of cooperative water resources investments that demonstrate to the basin population the benefits accruing from cooperation.

1.2 NBI's Climate Strategy

The Nile Basin is one of the most critical trans-boundary hydrological basins in Africa with the River Nile playing a crucial role and resource for most of the economic and social activities for the countries in Eastern and North-Eastern Africa. That said it is equally facing adverse effects of climate change which is expected to worsen in the future should little or no efforts be done to avert the current trends. Some of the associated challenges of the river basin include drought and flooding, heavy siltation, deteriorating water quantity, diminishing water levels, etc. This is within the backdrop that the region has high population growth, strong emerging economies and huge demand for its water and environmental services; all which place an unprecedented demand on these resources within the basin. Nevertheless, the Nile Basin Initiative, together with its partners is leading the adaptation against climate change and mitigation (through a low-carbon development path). In this regard, the **NBI developed a Climate Change Strategy** in July 2013 focused on trans-boundary water resources management as a strategic element of climate adaptation and low carbon development in the region. It integrates key strategic plans and activities of the NBI sub-programmes and provides a broader framework for action; one of which is through the implementation of climate services as provided for under Output 1. The Strategy serves as the overarching guiding document for NBI‟s efforts to support member countries in climate change adaptation on demand in their efforts and actions on climate change adaptation. The NBI Secretariat is commissioned to implement the strategy.

1.3 NBI as a Climate Service Provider

Over the past several years, the NBI has built its capacity in the generation of water resources data, information etc., and their application to address a wide range of trans-boundary water resources issues. This includes provision of climate services, amongst them sharing of information and technical support through an Integrated Knowledge Portal (IKP), a shared database on projects and initiatives in the region, an expert roster, the development of joint methodologies and analytical tools, and the targeted use of Decision Support Service (DSS) components to improve predictions on climate change impacts.

However, while the NBI has a clear mandate to develop and provide climate information services to its member states and other basin-wide users, the extent of expanding the range of products and services including reach out to end users is still limited. NBI still needs to sufficiently position itself as a provider of (value added) climate information and services. With that perspective, the Nile Basin Initiative-Climate Service Action Plan (CS-SAP) was developed, as a guidance document, from which a set of actions meant to improve the key climate services that are readily available, complete those under development or start those that are planned can be done. These activities are directly interlinked with decision-making processes relevant within the NBI context and aligned to key NBI strategic documents like the Climate Change Strategy and Policy Briefs. Through a bottom-up approach, it is expected that NBI can position itself to address climate information demands for specific needs while supporting decision making.

2. Objectives of the Climate Services Strategic Action Plan (CS-SAP)

The above explained rationale, sets the ground for developing the NBI-Climate Services Strategic Action Plan (CS-SAP) to structure the process and setting out strategic actions on improving NBI's role as a climate service provider. This is with a view to make NBI a regional mediating leader in climate service provision to basin countries within the Nile Basin region.

Thereby, the objectives of the CS-SAP are:

a. Defining NBI‟s role as a climate service provider.
b. Reviewing existing products and elaborate on new products for up-take as a standing service to NBI‟s member countries.
c. Establishing the basis for developing institutionalized mechanisms and workflows to effectively provide climate services to its users; and
d. Identifying strategic actions for the dissemination, use of climate service products, education, training, and capacity development in the Nile Basin.

The CS-SAP builds upon the conceptual provisions of climate services to broadly recognize and provide an approach that:

a) Improves collection and production of climate & hydrological data, product generation and refinement, value-addition to products, (i.e. through enhancement of usefulness and usability), expanding the outreach, synergy and cooperation with other regional actors, etc.

b) Increases the adaptation of climate products and services to diverse contexts although some may be standardized or tailored to one specific purpose or user-context (for example application under the PIEVC protocol).

c) Encourages internal use of climate products and services for improvement; as well as external to strengthen sectoral cooperation with regional NMHS or international organizations (ICPAC, WMO, GHACOF, etc.); and

d) Helps acquire funding and continuous capacity building to improve the existing products and services, while introducing new ones.

The strategic action areas of this Action Plan cut across three different climate services dimensions:

- **technical** (e.g. equipment, data collection and storage, decision support and information systems, modeling, and projections),
- **services** (e.g. hosting, structuring, and facilitation of user interface formats, digital applications and platforms, customization services, standard product development such as early warning and forecasting, public awareness, etc.), and
- **institutional** (e.g. workflow for climate service delivery, policy, capacity building, cooperation frameworks, etc.)

To become effective and operational, these dimensions cover diverse disciplines of expertise and areas of intervention (meteorology, hydrology, risk management, information technology, engineering, public relations, political science, human resources, etc.) for which this CS-SAP provides strategic guidance. Going forward, the CS-SAP will need to be further unpackaged into “sector” specific work packages

(Operational action plans) that handle each of the existing and anticipated new products, services, and institutional arrangements and other strategic actions identified.

3. Development process of the CS-SAP

The CS-SAP is an overarching document that describes strategic action areas that cut across the three dimensions (technical, services and institutional) of CS and within several disciplines or industries while maintaining relevance to each product or services mentioned. Hence, the CS-SAP follows the value-chain approach of climate services, an assessment of demands and potentials for standardization of identified climate services, identification of climate services relevant for the specific purposes of NBI and its interest to serve a wider stakeholder count based on experiences as illustrated by the CS catalogue, and lastly an assessment of feasibility of opportunities.

To develop this Climate Services Strategic Action Plan, several activities were initiated and have since been accomplished; these broadly fall under the following:

a. Review and use of the developed framework on climate services which was provided by the German Weather Services (DWD).
b. Review all the NBI climate data and information products. Several background documents were scoped and shared with regional stakeholders for consultation and validation.
c. Streaming knowledge gained from piloting climate risk assessment of water infrastructure (Borenga and TAMS) using the methodology of the Protocol of the "Public Infrastructure Engineering Vulnerability Committee" (PIEVC), as well as the developed climate proofing guideline. These pilots have significantly enhanced the use of climate risk assessment information in planning and climate proofing of infrastructure within the region).
d. Align with a landscape of pre-existing key NBI policies, strategies, and guidelines like environment flows (e-flow), wetlands management and climate change strategies; and complement national efforts of NBI member countries; and
e. Developing the NBI- Climate Service Catalogue as a searchable collection of service oriented and demand-driven information (list of products and services) to support decision making, capacity and resilience building in climate services within the countries of and/or region of the Nile Basin.

The CS-SAP shall then be implementable through activities within a work plan specific to each product and/or services.

4. NBI's Vision and Role as a Climate Service Provider

4.1. Definitions and key pillars of climate services and the role of the NBI

According to the World Meteorological Organization (WMO-2014), Climate Services are "Providing climate information in a way that assists decision making by individuals and organizations; a service requires appropriate engagement along with an effective access mechanism and must respond to user needs." This therefore requires appropriate and iterative engagement to provide timely advisory that enables end-users comprehend and aid decision making for early preparedness and eventual action.

Climate Services are always end-to-end (all steps from data to decision-making) services which should be **ready to use** with due consideration of **user needs.** It is therefore important to keep in mind that all products, no matter which type, can only be considered as CS products if they meet CS criteria such as readily available, ready-to-use and tailored to the users‟ specific needs. Accordingly, the simple purpose

for climate services is to assist individuals and organizations in society with climate information to make improved decision-making. This requires appropriate and iterative engagement to produce timely advisory that enables end-users to comprehend and aid decision making for early preparedness and eventual action.

As illustrated by Figure 1**,** a generic framework for climate services is composed of 5 pillars, for which also the NBI is mandated to play a pivotal role

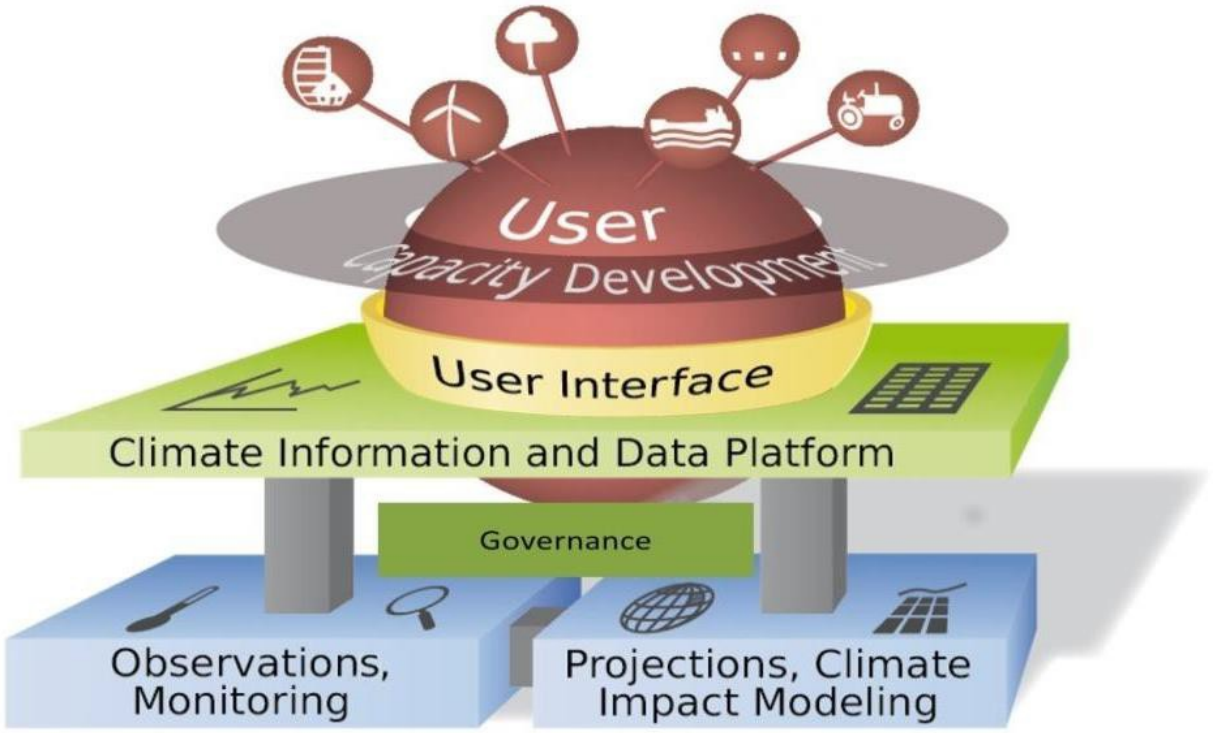

Figure 1: Key Pillars of Climate Services (adapted from DWD 2016)

The NBI-Secretariat provides authoritative data, data sets and derived information about the past, present, and future climate, as well as tools, capacity building, training, and technical support to enable climate change adaptation and mitigation strategies by riparian states in the Nile Basin. This includes key products and services such as databases on projects and initiatives in the region, an expert roster, the development of joint methodologies and analytical tools, and the targeted use of Decision Support Service (DSS) components to improve predictions on climate change impacts.

The specific roles of NBI as a climate services provider are presented by the Climate Service pillars, proposed by WMO:

(1) **Observation and Monitoring:** NBI gathers data from NHMSs, evaluate quality, and generate long-term station records (e.g. through climate regionalization to extend records at ungauged or poorly gauged sites), quasi-observed products (e.g. gridded data) to support water resources assessments in the basin.

(2) **Projections & Climate Impact modelling**: Climate and Hydrological Modelling & Projections are used for water resources planning and management, and related climate impact studies, within the Nile Basin. It facilitates analyses of the effects of climate change and extreme hydrometeorological events on agriculture, energy, infrastructure, and other sectors. Used together with the NBI‟s Decision Support Systems, this information can help users identify the need for and coordinate the implementation of adaptation and mitigation strategies. The NBI evaluates, assesses, and ranks the severity of these hydrometeorological scenarios on key sectoral assets within the Blue Nile and White Nile basins and sub-basins to help support action on resiliency-building. NBI technical experts use data drawn from global and regional climate models to provide local-scale climate change projections for climate indicators related to a range of climate conditions (e.g., air temperature, precipitation, sea level rise, winds/waves/extreme weather events). Technical experts then assess how changes in key indicators may affect hydrological and environmental hazards (e.g., coastal flooding, heatwaves, drought, windstorms, landslides, riverine flooding, wildfires, sand and dust storms) over time. NBI then disseminates this actionable information through its web portal.

(3) **Climate Information & Data Platform:** Climate Information & Data Platform provides various forms of data and information related to hydrometeorological observations, reanalysis datasets, hydrological forecasts and predictions, climate projections, and impact drivers (i.e., climate hazard indices), at actionable spatial and temporal resolutions and for specified periods, to support hazard assessment and adaptation planning within the basin. The objective is to provide application-ready and locally relevant information for use in impact, vulnerability, and risk assessments, and adaptation planning. This pillar further demonstrates how data can be used to help address key climate-related challenges to water infrastructure. The data tools and indicators provided by this pillar can be used by riparian states to help drive adaptation to climate change. For example, they can draw attention to, and help characterize, the impacts of droughts and floods on groundwater levels, stream and river flows, crop stress, soil moisture, and disruptions to transportation, for both historical time periods and projected future scenarios.

(4) **User-interface (co-design and capacity development):** User Interface Platforms are various centers and systems where NBI CS products and services are profiled, filtered, and grouped for multi-purpose uses, e.g., development of infrastructure systems, water supply, sanitation systems, flood protection infrastructure, irrigation, and hydropower, etc. The objective is to ensure ease of search and reference at any time of use by different groups. The information contained therein helps in communication and outreach by the NBI to different users and groups (e.g. project developers, staff, partners or potential clients, planners, institutional managers, policy makers, researchers, academia, risk managers, regulators, funders of different projects, etc.). The NBI uses its interface to guide users through step-by-step processes, giving instructions and hints on the selection and use of appropriate data, information, product, or services it provides. It also

draws upon a Decision Support System (within the Integrated Knowledge Portal) designed to meet the requirements of complex water resources planning with a diverse set of tools for data processing, modelling, visualization, scenario management, optimization and multi-criteria decision making. The NBI–ensures the quality, relevance, applicability, and upkeep of these resources. It also uses them to communicate with key stakeholders to provide advisory services, information, and tools for integrating environmental, social, and economic concerns that facilitate multi-sector engagement on water resources and trans-boundary planning within the basin.

4.2. NBI's Role in the Climate Service Value Chain

The governance of climate information production and provision plays a major role. From this point of view, a climate service product needs to be considered in most cases as a joint product of several stakeholders that requires cooperation and coordination to produce added value to users and – therefore – be ready to use in what would be regarded as its value chain. Climate service products are the results of service provisions by various stakeholders, characterized as climate data and information providers (blue box), intermediates (green box) and end-users (orange box), see *Figure* **.** The figure further illustrates how stakeholder types are subdivided by sub-types with specific stakeholders (colored area) as well as their functions regarding climate service development and provision (grey area) (GIZ 2018, modified from WMO-2018).

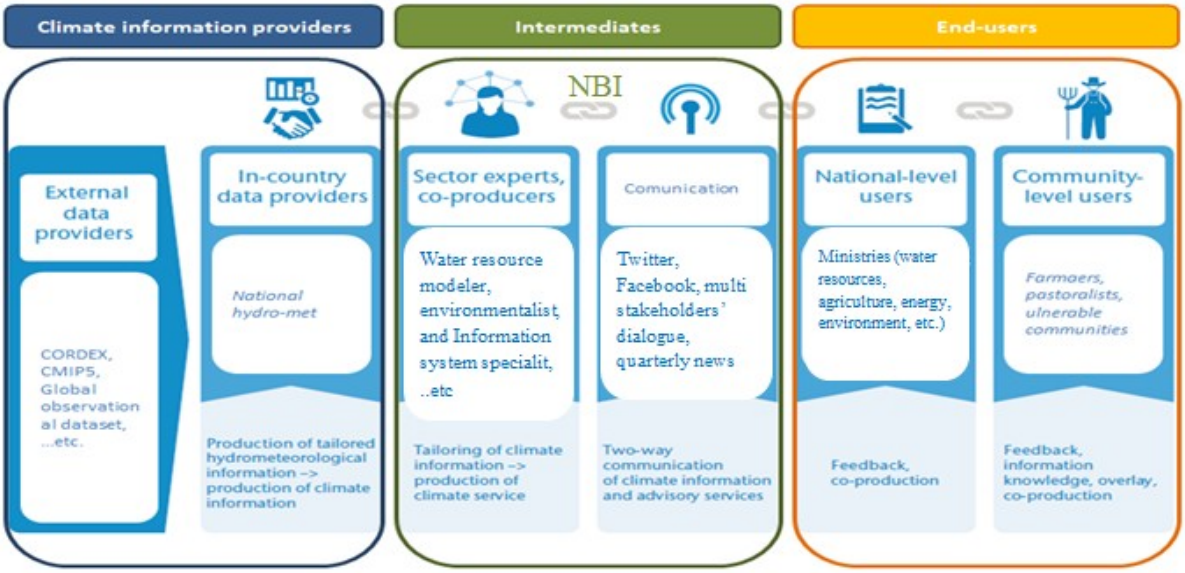

Figure 2: Presentation of Climate Service Value-Chain.

In general terms, the NBI has the potential to take a classic role of an intermediate climate service (Figure 2) provider regarding hydrological issues at a regional level. In this context, the NBI can take several tasks that enhance the provision of climate services for water sector, these may include:

a) Establishment of a regional hub for trans-boundary climate information and knowledge by pooling regional data within a central data and information portal.
b) Provision of added-value products for the water sector on the regional level.
c) Provision of methods, support, guidance, and training for climate change adaptation.
d) Communication and dissemination of climate change knowledge and application options.

e) Moderation of provider-user exchange.
f) Tendering and coordination of research and adaptation projects.
g) Acquisition of project funding; and
h) Provision of targeted climate services that offer a variety of choices to the institutional decision maker and the intended end-user.

More specifically, the NBI as a trans-boundary water management platform is well equipped to play a main role as an intermediate CS provider for hydrological issues at the regional level. Such a role centers the NBI to facilitate and coordinate user needs and interests with NMHSs and regional organizations which provide climate data and information for the water sector. This helps to fill the prevalent and critical gaps within the climate-value chain and interlink primary providers of climate data and basic products. The NBI thus adopts the role as intermediate and knowledge broker in the climate-value chain and as a sectoral champion for the water sector on a regional level. As sectoral champion, the NBI can support the work of the NMHSs on adaptation to climate change within the water sector by taking part in the development of tailored CS products for the water sector and by using its collaborative role in calling for policy change to free and open data sharing within the basin among others. Other central roles may include:

a) The provision and guidance on relevant and appropriate climate projections for hydrological issues in the Nile basin.
b) The provision of climate services relevant sectoral planning and design (e.g. for infrastructure, farming, irrigation, etc.).
c) The guidance on appropriate methods on risk assessment for water resource development in the Nile basin; and
d) The provision of support to countries to access climate funding.

Therefore, to fulfill these roles, existing technical resources, and capacities, as well as climate information products developed for CS provision shall be considered. This involves a call for strong cooperation with NMHSs of the partner countries as well as regional and international organizations, especially the Greater Horn of African Climate Outlook Forum (GHACOF). GHACOF is hosted by IGAD Climate Prediction and Application Center (ICPAC) and is already quite active in the provision of CS products for the region.

4.3. NBI's Role in the workflow of Climate Service Delivery

A closer look at NBI‟s modes of climate service delivery in its function as an intermediate provider is an important cornerstone for the development of this CS-SAP. The NBI‟s workflow along the so-called **climate value chain** describes an end-to-end climate information production cycle that "is characterized by one or several steps of value-adding which might be tailoring of data or provision of information and services, etc. to make climate information usable" (GIZ 2018:19). Climate services and products development and delivery include three dimensions: 1) technical, 2) service and 3) institutional as illustrated by Figure 3. The technical dimension turns data into useful information by tailoring of the data. The service dimension turns useful information into a usable climate information product by tailoring the presentation and format of the information as well as providing user-specific support and advice. The

institutional dimension provides the institutional framework within a co-production of climate services can be realized by the cooperation of climate information providers and users.

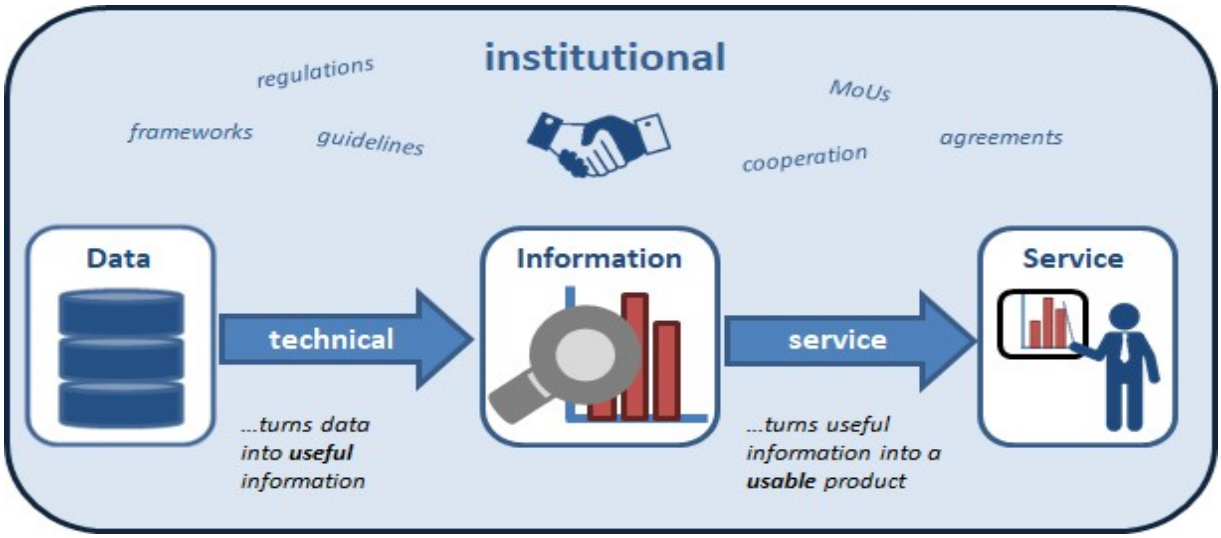

Figure 3: The NBI workflow of Climate Services delivery.

A CS product does not only need technical input but also needs to focus on the provision, communication, and advice on climate information, as well as the interaction with users and other stakeholders (user interface platform). Still within the value-chain of NBI climate services, there are products which are highly tailored or contextualized information products available to build capacity, support use and decision making among developers and intended recipients. Moreover, NBI also provides Communication & Outreach products such as the NBI website or climate services portal which remain platforms to get out the desired information and receive feedback.

4.4. Improved transparency on NBI's Climate Services – The Climate Service Catalogue

Considering that climate services are intended to provide climate information in a way that assists decision making by individuals and organizations, the NBI has since embarked on the development of a Climate Services Catalogue (CSC), available on NBI's Integrated Knowledge Portal (IKP) (www.ikp.nilebasin.org). An edited version of the CSC can be found within the Annex (Chapter 8). This should facilitate appropriate engagement with an effective access mechanism that responds to user needs. The climate services catalogue has thus been developed as a central hub (nilebasin.org/hub) where NBI products and services may be listed and described for easy reference and use. The catalogue lists several different climate service products that broadly cover the value chain of climate services from hydrological and meteorological observation data and repositories to be employed for standardized climate service products or customization services in hydrological modelling, forecasting and scenario development. Furthermore, the services also have products which support decision making, provide communication & outreach and lastly user support & training. These products or services are at different stages of use or development and as such, they are listed as those that already exist or are planned. Some of the existing products and services may need special permission from mostly in-country partner agencies (NHMS) to be accessed. Hence, some products may need enhancement while others may need to be developed or actively put into use.

The NBI has developed a Climate Services Catalogue (CSC) to profile its climate services products used within its work. The CSC is a searchable collection of products and services which are oriented and demand-driven information towards support of decision making, capacity and resilience building in climate services within the countries of and/or region of the Nile Basin. Moreover, there are those products that exist to improve or enhance the usability of others such as forecasting, modelling products, etc.

The products are categorized based on their primarily support within the climate services value chain and suggest relevant activities to refine or add value, thereby creating the CS-SAP. Such a value chain, which is mostly bottom-up envisages a pro-active integration of users in the process of determining relevant CS products by the NBI together with their primary CS providers and guarantees the usefulness and usability of CS products by the end-users.

The classification is characterized by defining "product types" of Climate Services:

- **Data generating and management products**
- **Standardized and customizable data and information products**
- **Climate Service meta products**

These are sets of independent units or standardized parts of climate services which when combined with others can be used to produce climate services tailored to users‟ needs. The benefit of defining CS product types is their multipurpose combination and application for many different CS products at the same time which is very efficient in production and maintenance (e.g. climate raw data). As such and in relation to this, climate service product development integrates all steps (processes), from data collection to decision-making and provide ready to use climate information that is defined and tailored to the user's needs in what would be referred to as end-to end. In this attempt, the characteristics of the climate services products must be identified by defining the users and their needs. This may also include the entry needs for climate or model data as well as for information on the user context, which need to be predefined and the user is guided to make appropriate selections to fit within a specific module.

The CS-SAP takes a multi-product-type approach to comprehensively acknowledge the entire spectrum of requirements of effective climate service delivery.

The CSC and NBI‟s Climate Service Hub (www.nilebasin.org/hub) are part of the framework upon which the Climate Services-Strategic Action Plan was developed. The aim is to continue developing new services, improving existing ones and plan for future services to strengthen the NBI as a Climate Service Provider and to support better decision-making and increase end-user outreach.

5. Climate Service Strategic Actions

The CS-SAP features overarching activities proposed for the categories of products and services for which the provided information on the product or deliverable is intended for improvement through knowledge of the current state of product/service, the objective for improvement and a set of priority activities proposed. This may be done either as project based or process based[1] that aggregates activities most common to most products and services but also considering those products and services currently in use or related to on-going projects.

5.1. Overall strategic actions for climate services

Below, the different categories of CS-product types, as they are used for defining the different climate service strategic actions, are elaborated, as follows:

CS-data generating and management products

These refer to the climate information products itself (technical dimension) and comprise various forms of value-added climate information e.g. climate data, climate analysis, impact analysis, etc. CS-data gathering products can be enhanced by:

a) Strengthen cooperation framework agreements with the NHMS of NBI countries on data sharing and equipment installation & operation.
b) Optimize the full functionality of Hydrological monitoring systems by ensuring the network meets the required networks density and operational standards.
c) Increase reliability and performance of the data from Nile Basin Hydrological Monitoring System by enhancing the process of turning data into information.
d) Increase data sources and quantity for use to validate information derived from these products.

Standardized and customizable data and information products

These are products not used for their own sake but to generate another value-added climate-related information product, e.g. climate data set used by a consultant (an intermediary within the value-chain) for risk assessment may become a Climate Service product once it is tailored to the intermediate needs with specific characteristics (e.g. format, quality, access mode, etc.). Standardized and customizable data and information products can be enhanced by:

a) Optimize the full use of possibilities within this product range by understanding current use and then widening scope of use.
b) Increase reliability and performance of information derived from these products by widening scope of use to get user-/problem-specific climate information for specific user groups.

[1] "Project-based" is where an office delivers services as "new" activities with independent start dates and end dates, specific deliverables etc. while the "process-based" approach is where each office delivers on activities heavily linked to current and on-going activities.

c) Increase reliability of the information and source of products by testing performance (forecasted/predicted vs. observed).
d) Increase specific application or customization of product information to different user groups and locations.
e) Improve on costumed tailored information for other specific applications and multipurpose use.

Climate Service meta products

These are mostly services specifically designed to address the usability of one specific or several core modules (service dimension) and comprise standards, tools, guidelines, trainings, or other supplements to address the usability of and access to climate data and information products but in a general way such as through portals, user interfaces, platforms, help desks, CS infrastructure and formats of user-exchange, learning and support, etc. Climate Service meta products can be enhanced by:

a) Increase specific application of products to different user groups and locations.
b) Improve capability for tailoring information for other specific applications and multipurpose use.
c) Provide justification for the application of a given CS product with visible results to a particular user or location, etc.
d) Improve use, transfer, and capacity of the NBI in using the listed products.

5.2. Climate Services Strategic Actions to strengthen NBI's institutional capacities for the effective provision of Climate Services

Table 1:Proposed Activities for the Climate Services Strategic Action Plan to strengthen NBI's institutional capacities for the effective provision of Climate Services

ACTION ITEM	**Product status**			**PROPOSED ACTIVITIES**	**TIMEFRAME**		
	Available – actions necessary	**To be planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
Implementation, Monitoring and Evaluation of NBI"s progress in CS			x	1) Continuous monitoring, evaluation and update of Climate Services Catalogue and Strategic Action Plan. Wide stakeholder involvement for the validation and evaluation of the CS-SAP	[redacted]	[redacted]	[redacted]
		x		2) Development of the Climate Services Operational Action Plan per CS-product or services within the CS-SAP. The CS-SAP cuts across the many different climate services dimensions (technical, services and institutional) and industry specific disciplines within the value chain. Through different work packages (budgets, timelines, and capacities), further development into industry specific action and work plans can be achieved.	[redacted]	[redacted]	[redacted]
Development of internal standard workflow procedures and capacities for of Climate Service		x		1) Develop digital and institutional workflow procedures and workstreams for effective climate service delivery, through the analysis of gaps and demands, as well as the capacity of NBI to deliver climate services.	[redacted]	[redacted]	[redacted]
		x		2) Create a business plan for NBI"s Climate Service delivery, that clearly positions NBI in the climate service value chain and its modus operandi of cooperation between the diverse stakeholders that provide and use climate services.	[redacted]	[redacted]	[redacted]

Delivery		x		3) Recruit a Climate Services Expert (CSE) Position/Office. This will either be by creating a CSE office or position at the NBI and/or expanding on an existing role of a current member of			

ACTION ITEM	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	To be planned with funding	Envisioned without funding but important		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
				Staff to handle the role.			
Liaise with important stakeholders in the climate service value chain			x	1) Develop, where appropriate institutional cooperation frameworks with relevant national, regional, and international agencies and institutions for data and product sharing			
			x	2) Engage in dialogue with relevant stakeholders framed above and who play a role in the Climate Service Value Chain to define "lab our sharing" modes of operation and collaboration.			
			X	3) Strongly liaise with the private sector and enable the development of a market for climate service delivery and advisory services for climate change mitigation and adaptation.			

5.3. Strategic actions for data gathering and management products

Table 2: Proposed Activities for the Climate Services Strategic Action Plan for data gathering and management products

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	Planned with funding	Envisioned without funding but important		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
Nile Basin	x			1) Develop or review cooperation framework agreements with the			

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**Planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
Regional Hydrological Monitoring Network				Regional National Hydrological Meteorological Services (NHMS) within the NBI countries, which may provide for: sharing of technology, network design, operational and maintenance, joint purchase agreements, etc.			
				2) Completion of the Nile Basin Regional Hydrological Monitoring Network and testing.	[redacted]		
				3) Together with the NHMS, carry out quality checks and operational maintenance of hydrological monitoring system into a database		[redacted]	[redacted]
				4) Together with NHMS, increase station density, network coverage and data collection by the standard requirements of World Meteorology Organization (WMO); as per number of stations per square meter, time series, relevant parameters and indices, terrestrial and topographic data, etc.		[redacted]	[redacted]
				5) Together with NHMS, share user-friendly network systems and interfaces e.g. computer software and system relays in real time, etc.	[redacted]	[redacted]	[redacted]
Nile Basin hydro-meteorological data series	x			1) Develop or review cooperation framework agreements with the Regional National Hydrological Meteorological Services (NHMS) within the NBI countries - that may handle issues like joint purchase agreements, data, and product sharing, etc.	[redacted]		
				2) Establish climate and hydrological data collection and storage guidelines and protocol against industry (e.g. WMO) standards on data sharing, quality analysis, projections, and specific		[redacted]	

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**Planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
				decision-making contexts like impact assessments)			
				3) Evaluate the use of models and other tools according to industry (e.g. WMO) standards e.g. for tailoring and analysis of data, storage, and the visualization of relationships among diverse variables in different scales and for specific cases and for a specific region, etc.		[redacted]	[redacted]
				4) Carry out an inventory of current services associated with data management and quality management systems, training, and compare with available options in the industry standards;	[redacted]	[redacted]	
				5) Assessment of demands, opportunities, potentials, and feasibility for standardization (identified data, products, and services, etc.) so as to cross over into other industry players especially commercialized work for the private sector, research institutes, etc.		[redacted]	[redacted]
Climate Change Scenarios for the Nile Basin	x			1) Implement an inventory of database, tools and systems used by NBI to support the production and validation of these products to determine level of quality and requirements for improvement.	[redacted]		
				2) Carry out an evaluation of performance (forecasted/predicted against observed or actual results of these information products) and how it relates to global climate model predictions of the region.		[redacted]	
				3) Increase on the application and relevance of product for the NBI region by increasing on time, coverage, location, projections and impacts as appropriate		[redacted]	[redacted]

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**Planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
				4) Conduct further case-studies on climate risk assessments for specific industry related areas such as on infrastructure, agriculture, water, etc. within the Nile Basin;	[redacted]	[redacted]	
Hydrological scenarios for the Nile Basin	x			1) Carry out an inventory of database and tools used by NBI to support the production and validation of these products to determine level of quality and requirements for improvements.	[redacted]		
				2) Evaluate level of integration and support of these products into other value-added climate and hydrological products such as NBI‟s DSS including introduction into other location, regions, etc.		[redacted]	[redacted]
				3) Carry out an evaluation of performance e.g. forecasted/predicted against observed or actual results of these information products to increase on relevant and appropriate application of product within the NBI region;	[redacted]	[redacted]	[redacted]
				4) Scope the number of specific industry derived products, services, and an inventory of existing applications to allow for specific integration into private sector and research work e.g. hydrological impacts (loss & damage) or hazards, trend analysis, etc.			

5.4. Strategic actions for standardized and customizable data and information products

Table 3: Proposed Activities for the Climate Services Strategic Action Plan standardized and customizable data and information products

CSC-PRODUCTS	Product status	PROPOSED ACTIVITIES	TIMEFRAME

	Available – actions necessary	**Planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
Nile Basin Hydrological Bulletin	x			1) Evaluate level of reach and use of the bulletin and transform the products into other ease to use formats for effective handling, outreach and feedback e.g. digital tool, apps, etc.	[redacted]		
				2) Carry out an evaluation of performance and value addition of those using these products e.g. comparing segments (population, region, industry, etc.) using the products vs. those not using the product;	[redacted]	[redacted]	[redacted]
				3) Review the processing and other analytical techniques which should further inform the need for licenses of use, user information (last update, graphics, formats, identifiers, etc.)	[redacted]	[redacted]	[redacted]
				4) Carry out an inventory of current services associated with product, compare with other options in the industry and integrate into other products to discovery potential high- value hidden relationships;		[redacted]	
Flood early warning for Eastern Nile	x			1) Determine level of quality, requirements, production, and validation of the product by testing of datasets, tools and systems used against other industry standards. These may be technical (e.g. daily water level and rainfall situation, hourly situation updates, rainfall surface map, flood inundation map etc.) or non-structural/technical solutions (e.g. participatory risk assessments, gender-inclusion, etc.)	[redacted]	[redacted]	[redacted]
				2) Evaluate level of reach and use of the warnings and transform the warnings into easily adoptable formats for effective handling, outreach and feedback (e.g. digital tool for situation updates, introduction of interactive voice response (mobile voice message), special outlook and press briefings, etc.)	[redacted]		

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**Planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
				3) Evaluate level of integration and support of these products into other value-added products and services to optimize full use e.g. through "shift from a reactive to a proactive approach", impacts of the project and post-project assessment, etc.		[redacted]	
				4) Carry out an evaluation of performance and value addition by using these products comparing into different domains (areas, regions, industry, etc.) within the current use areas and extend to other NBI regions;	[redacted]		
Nile Basin River Flow Forecasting System	x			1) Quality proof the tools and data used for the production and validation of the product including evaluation of performance e.g. forecasted/predicted against observed or actual results of these information;	[redacted]		
				2) Evaluate possible level of integration of the products into other value-added hydrological products and how to expand on its use within the region, optimize full use through "real time reporting", etc.		[redacted]	
				3) Integration of systems into advance technological requirements for data collection, transmission to a center and storage; developing models and producing forecast products to enable an "end-to-end" system that consists of many interconnected components, etc.;		[redacted]	
Drought Forecasting System	x			1) Determine level of quality required for production and validation of the drought forecasting system by testing of datasets and observational tools used against other industry standards to enable better analysis, dissemination and	[redacted]		

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**Planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
				communication of the forecasts, etc.			
				2) Evaluate level of integration and support of these products into other value-added products and services to optimize full use including a performance evaluation of predicted vs. actual, populations‟ acceptance of warnings and how it informs public order to take appropriate actions and the general feedback loop.		[redacted]	
				3) Scope and integrate systems into advance technological that enables machine learning, improves long range drought forecasts with increased degree of certainty, communication, and emergency response plans towards different but key actors like meteorological organizations, decision-makers, disaster planners and relief organizations, etc.		[redacted]	[redacted]

5.5. Climate Services Strategic Actions for Climate Service meta products

Table 4: Proposed Activities for the Climate Services Strategic Action Plan for Climate Service meta products

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**To be planned with funding**	**Envisioned without funding but important**		Short-Term (0-3 yrs)	Mid-Term (4-6 yrs)	Long-Term (7-10yrs)

Climate Proofing Guidance Hub		x		1) Completion and testing of the Climate Proofing Guidance Hub for Infrastructure and Basin Planning; including testing through user-experience workshops, application coaching and support.			

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**To be planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
for Infrastructure and Basin Planning				2) Create an „asset, equipment and user" inventory and records for the test projects in using the climate proofing guideline	[redacted]	[redacted]	
Nile Basin Decision support tool	x			1) Carry out an inventory of current services associated with product, compare with available options in the industry and determine level of variance for improvement.		[redacted]	[redacted]
				2) Produce an assessment or query report involving user needs (indices calculation), identified cooperation and partnership's needs, and how to integrate the product into other regional services and services for resilient water infrastructure investments.	[redacted]		
				3) Promote cooperation agreements with NMHSs of the partner countries as well as regional and international organizations, especially the Greater Horn of African Climate Outlook Forum (GHACOF) and IGAD Climate Prediction and Application Center (ICPAC)	[redacted]	[redacted]	
Climate Service Portal		x		1) Finalize the Climate Service Portal and integrate it with the Climate Services Action Plan.	[redacted]		
				2) Create an inventory and records of needs, users, contacts, etc. of who are most likely to effectively use the climate services portal. There should already be services and user specific information such as: information format, licenses, identification and search packages, resource locator function and protocol,	[redacted]		

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**To be planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
				graphics, registration details, etc.			
				3) Integrate the test results from the climate services portal into current NBI work to improve on climate risk assessments, decision-support, and adaptation for the water sector in the Nile Basin; in a similar way to the CS knowledge hub[2] hosted by the NBI.			
Policymakers & Technical Experts Awareness-raising Products	x			1) Examine and evaluate the level of reach and usage of the policy and technical awareness products and transform the products into other ease to use formats for outreach and feedback e.g. digital tool, apps, etc.			
				2) Establishment of institutionalized user fora for stakeholders, knowledge center and user interface platforms to ease communication and feedback. Including policy dialogues on access and sustainable use of water resources, trans-boundary collaborations, etc.			
				3) Raise awareness and profile of the key legal, institutional, finance, human resources, administration and organizational policies, regulations, systems, and procedures for the benefit of NBI staff, partners and general public;			

[2] http://nilebasin.org/index.php/information-hub/knowledge-platforms

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**To be planned with funding**	**Envisioned without funding but important**		Short-Term (0-3yrs)	Mid-Term (4-6yrs)	Long-Term (7-10yrs)
				4) Continue engagement with communities and increasing visibility in the NBI region through awards, competitions about the NBI, celebration of national and international water days, etc. For example through NBI Media Awards, World Hydrological and Meteorological Days, etc.	[redacted]	[redacted]	[redacted]
Capacity Building		x		1) Carry out an inventory of capacity building and training needs required by the NBI and its affiliates to prepare the design of training and knowledge resources into key needs;	[redacted]		
				2) Develop an online e-learning portal for access to Climate Services and resilient infrastructure training at a 24/7/365 level. Attract and cooperate with other sector players including research institutes, private sector players through cooperation and partnerships agreements (e.g. the Water Resources Institute-Entebbe, regional universities, and consultancy firms, etc.)	[redacted]	[redacted]	[redacted]
				3) Establish a database on pool of experts, user needs, capacities of staff, outreach and communication needs etc. including training center or partners – (e.g. Water Resources Institute-Entebbe),	[redacted]		
				4) Produce and share training reports on the previously successful work done e.g. in key operational areas for NBI like climate data analysis and processing, data management, projection data interpretation and communication, projection data handling and analysis for hydrological purposes, etc.	[redacted]		

CSC-PRODUCTS	Product status			PROPOSED ACTIVITIES	TIMEFRAME		
	Available – actions necessary	**To be planned with funding**	**Envisioned without funding but important**		Short-Term (0-3 yrs)	Mid-Term (4-6 yrs)	Long-Term (7-10yrs)
				5) Establish partnerships and collaborative programmes and activities that provide motivated and adequate manpower, adequate space for supporting the applied training, applied research, dialogue and outreach functions, etc.	[redacted]		
				6) Establishing and involvement of supportive governance structures and processes which approves participation of staff into partners work, openly sharing curriculum, training, and skills enhancement reports, sharing success stories of distance-learning, engagement of retired regional professionals, and providing platforms for sharing of experiences and challenges.	[redacted]	[redacted]	[redacted]

6. Conclusions and Recommendations

The CS-SAP is comprised of activities reached after review of the current state and knowledge of the various climate service products and services to show opportunities for improvement but also suggestions of what is missing within the entire CS value-chain. This should provide completeness of products and services spread along the data collection and management systems, the standardized products and customization services, as well as the institutional arrangements for making NBI fit as a climate service provider, including the development of a business plan and increasing its capacities.

Going forward, the CS-SAP recognizes the continued need for institutional development, data collection for analysis, product/ service generation and adaptation to diverse contexts although some may be standardized or tailored to one specific purpose or user-context, such ss the climate proofing of infrastructure investments.

There is also a need to test the variability or performance of all existing products and services to see their compliance to international or industry standards. While there is a need for more or better cooperation with regional NMHS and international organizations (ICPAC, WMO, GHACOF, etc.) to leverage on sharing existing products and services to reduce costs, acquire funding and continuously build internal NBI capacities. Challenges of limited resources must be addressed to ensure implementation of the CS-SAP and Work Plan Manual.

7. References

GIZ (German Development Cooperation-2018), https://www.adaptationcommunity.net/download/climateinformation/Report-Climate-Services-Germany-Carolin-Frisch.pdf

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Integrated Flood Risk Analysis and Management Methodologies-Floodsite (https://www.floodsite.net/)

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Source-Pathway-Receptor-Consequence (S-P-R-C) model, http://www.floodsite.net/html/faq2.htm

WMO (World Meteorological Organization -2014), Climate Services for Supporting Climate Change Adaptation, https://library.wmo.int/doc_num.php?explnum_id=7936

WMO (World Meteorological Organization -2018): Step-by-step Guidelines for Establishing a National Framework for Climate Services. Geneva, Switzerland. http://www.wmo.int/gfcs//step-by-step-guidelines-nfcs

8. Annex- The Nile Basin Initiative Climate Services Catalogue

The NBI-Climate Services Catalogue contained in this CSAP annex is an edited version of the main document which can be found within the NBI's Climate Service Hub. This version contains information on the objectives, methodology and expected benefits for the development of the NBI- Climate Service Catalogue (CSC).

The Nile Basin Initiative-Climate Service Catalogue is a searchable collection of service oriented and demand-driven information to support decision making, capacity and resilience building in climate services within the countries of and/or region of the Nile Basin. Accordingly, the simple purpose for climate services is to assist individuals and organizations in society with climate information to make improved decision-making. This requires appropriate and iterative engagement to produce timely advisory that enables end-users to comprehend and aid decision making for early preparedness and eventual action.

8.1. Executive Summary:

The Climate Services Catalogue (CSC) of the Nile Basin Initiative (NBI) has eight (8) climate service products which are readily available while another five (5) are either under development or planned. Of the 8 products and services that are readily available, two (2) may be considered as only auxiliary since they contribute to the functioning of some of the other products.

These CSC products do complete most functional aspects of the Climate Services Value Chain, where some of the products are considered as part of the hydrological and meteorological systems used for the collection and storage of raw input or model data, which may later be used for the development of other products that lend themselves to address specific or multipurpose uses, either as per specific user type or location. Secondly, there are those products that exist to improve or enhance the usability of others such as forecasting, modelling products, etc. Still within the value-chain of these NBI climate services, there are products which are highly tailored or contextualized information products available to build capacity, support use and decision making among developers and intended recipients. Finally are communication & outreach products such as the NBI website or climate services portal which remain platforms to get out the desired information and receive feedback.

Going forward, this Climate Services Catalogue will lead to the development of the Climate Services Action Plan (CSAP) and Work Plan Manual which will provide priority activities with the intention to enable improvement of the existing services and the completion of the planned services. This can also be seen to enhance use and extension to other sectors, for example through the adoption of various digital platforms (e.g. social media), which is a service beyond its current websites but may facilitate an easier and quicker way to communicate and disseminate data and information.

The NBI should use the services and/or networks of their associate National Hydrological and Meteorological Services (NHMS) bodies to further help coordinate the compilation, production, proof reading and distribution of this catalogue but equally, these national entities should be cooperated with to ensure that the data and information used to (re-) produce another CSC edition is continually up to date and authenticated. This will help accelerate the implementation of Climate Services (CS) at both national and regional levels.

8.2. Objective of the NBI- Climate Service Catalogue

The objective of the climate services catalogue is for the NBI to show its climate products and services in a

systematic and centralized form. The catalogue is intended to serve as an easy reference by providing a clear and vivid overview on the climate service products that are readily available and/or planned by the Nile Basin Initiative. The CSC products and services range from the provision of information, data, software tools, to training resources and other products and services that enables the NBI and other potential users such as project developers, engineers, policy makers and researchers to keep record of what is available or planned and how it may be used to support at regional, national, and sub-catchment levels. Specifically, the CSC aims at:

i. Providing a data and information portal in the public domain for access to and analysis of observations.
ii. Assisting in management, quality control and analysis of data and information, which should eventually lead to improved forecasts and predictions, for better decision making in the region.
iii. Supporting in the dissemination, education, training, and capacity development in the Nile Basin; and
iv. Establishing the base for developing the Climate Services Action Plan (CSAP) and Work plan Manual which shall be a series of priority activities to either ease implementation of existing products or complete those under development or those which are still planned, while improving what already exists including their access to the eventual end-user.

8.3. Methodology for the Climate Services Catalogue

To get to this Climate Services Catalogue, several activities were initiated and have since been accomplished; these broadly fall under the following:

i. Review and use of the developed framework on climate services which was provided by the German Weather Services (DWD) in phase 1.
ii. Review all the climate data and information products prepared by NBI. Several background documents were scoped and shared with regional stakeholders for consultation and validation.
iii. Streaming knowledge gained in Public Infrastructure Engineering Vulnerability Committee (PIEVC), climate proofing guideline, and risk assessments (The NBI together with GIZ has been implementing the project-Climate Services for Infrastructure Investments. This has enhanced the use of climate risk assessment information in planning and climate proofing of infrastructure within the region).
iv. Align with a landscape of pre-existing key NBI policies, strategies, and guidelines like environment flow (e-flow) and climate change strategies; and complement national efforts of NBI member countries.

8.4. Outcomes & Benefits for the Climate Services Catalogue

The CSC has enhanced the understanding of climate services within the Nile Basin region and provides NBI a systematic analysis of products and services readily available (or planned) for the benefit of the basin countries. More specifically, this study has contributed to an enhanced understanding of the available (and planned) climate service provided by the NBI while indicating those under development and suggested areas of improvement for example missing data and information that is needed to be compiled for further advancement of products. The CSC also suggests several important findings that help the NBI to communicate its work to various stakeholders; this is possible through such structured work in standardized formats that help external parties and end users retrieve information from various NBI platforms.

8.5. Summary to the NBI- Climate Service Catalogue

The climate service catalogue consists of eight (8) readily available products and five (5) products under development or planned. These products may be broadly classified as: Hydrological and Meteorological Products, Climate Change and Hydrological Scenario Products, Tailored Hydrological Modelling and Forecasting Products,

Decision-Support Tools, Climate Service Communication & Outreach Products and User Support & Training Products.

These products have been listed in **Error! Reference source not found.** and the information contained therein include: the product/service code (PX or APX-where P or AP is Product and the X denotes a number), product name and description, the access in terms of format (e.g. modes of purchasing and storage format) and the primary provider within the NBI, the purpose of product and targeted audience (e.g. the specific areas of use). It also includes the status of the product in terms of whether it is readily available or simply under development or planned. More information about each product has been included into a product poster (see Annex) but generally, each product poster which has been provided has similar information as above but only expanded in some cases to include among others: the Title, a Photo Representation, the NBI Logo, Product Category and Purpose, Value-Chain Category and Purpose, Characterization & Functionality, Target Audience, System set-up or input, Similar Category or Interlinked NBI products, Availability and access, and the Provider & their Contact.

Table 5: Overview on the available NBI Climate Service Categories and Products

Code	Products	Brief Description	Access & Format	Targeted audience	Product Purpose or use	Provider & Status of service
P1.	Nile Basin Hydrological Bulletin	This is a quarterly bulletin of spatial distribution of monthly and seasonal components of the water cycle such as rainfall, actual evaporation, water levels, and comparison with historical average in the Nile Basin sub-basins using global observational dataset and satellites data observations (such as "The Nile Basin Satellite Observations"). The soft copy of the processed data is also available.	Bulletin (Publication). ● Email (nbisec@nilebasin.org) and Google drive ● NBI website (http://115.124.114.193:8100/ikp/en/knowledge-repository	Reservoir, spillway and dam owners & managers, underground /borehole owners; Disaster risk (Flood and drought warnings) managers; Water resources planners etc.	To provide an overview of the hydrological conditions for a featured period; these may include or be for: triggering drought and flood concerns, report in groundwater levels, streams and rivers levels, model agricultural stress, provide soil moisture deficits, replenishment of reservoir stocks and forecast on transport disruption etc.	The service is readily available and held with Nile-SEC
AP1.	Nile Basin Regional Hydrological Monitoring Network	Although these are not within the scope of NBI climate services, they are networks that belong to member states but are shared with the NBI through cooperation agreement. These are hydrological monitoring networks which do generate near real time flow and river level data on selected gauging stations of the Nile and its sub-basins	Infrastructure (installations) ● NBI website (https://nilebasin.org/) ● Each riparian countries institutional website	National Meteorological and Hydrological Services. Hydrological product developers, Universities, and research organizations	Collection and transmission of hydrological time and data series; Use of hydrological data in the planning, design and operation of water-resources projects, and the cost-effectiveness of the information through socio-economic analysis, theories of probability, sampling, and optimization, etc.	The services are readily available although it needs individual country permission

AP2	Nile Basin hydro-meteorological data series	These are historical hydro-meteorological data from different projects although they are not specifically within the scope of NBI climate services, the networks belong to member states but are shared with the NBI through cooperation agreement. These shall be provided under the Decision Support System and as hydro-met data series	http://115.124.114.193:8100/ikp/en/hydromet-component	National Meteorological & Hydrological Services; Meteorological product developers (e.g. forecasters, predictors etc.), Universities and research organizations, Agronomists, transport officers,	Collection and transmission of meteorological time and data series for daily, monthly, and seasonal weather and climate forecasting and prediction; but also planning, design and operation of water-resources related projects.	The services are readily available although it needs individual country permission
P2	Climate Change Scenarios for the Nile Basin	These are climate change scenarios within the Nile Basin with bias corrected Global Climate Models and Regional Climate Models into future climate change projection data, downscaled GCMs data, and information for the Nile basin which is essential for planning the management of water resources and climate impact study in the water sector. On call service for specific catchment and as a guidance document on the ways of statistically downscaling and bias correcting climate change scenarios data for sub-basins	Bulletin (Publication). ● NBI website (https://nilebasin.org/) As NBI technical report ● http://115.124.114.193:8100/ikp/en/knowledge-repository	Water Resources planners, hydropower production and irrigation water release experts, Agricultural water suppliers,	This provides guidance of climate change scenarios within the Nile Basin used to assess the potential impacts of climate change on the hydrology and water resources of the Nile River basin through variability and implication in the magnitude, direction, and seasonality of projected precipitation changes and stream flow as affected by temperature changes. The data is drawn from 34 Global Circulation Models and 18 regional climate models and evaluated and ranked based on their performance over each of the 10 sub-basins. Also data and information dissemination portal to be established which will be	The service is readily available and held with Nile-SEC

		of the Nile Basin and generally climate change projections data for the Nile Basin to the different types of users. Relatively high-resolution data may be provided upon request from Nile basin institutions.			essential for planning the management of water resources and climate impact study in the water sector.	
P3	Hydrological scenarios for the Nile Basin	This is a hydrological dataset for the development and provision of different hydrological scenarios of the Nile Basin under a range of climate change projections scenarios. It is also an analytic service to provide processed data for specific areas upon demand by end users. This is essential for planning and management of water resources including the study of climate impacts on the water sector.	Bulletin (Publication). ● NBI website (https://nilebasin.org/) ● It is planned to be disseminated through the IKP	Reservoir, spillway and dam owners & managers, Underground /borehole owners; Disaster risk (Flood and drought warnings) managers; Water resources planners etc.	Based on climate change projections from five regional climate models, different scenarios of hydrology of the Blue Nile and White Nile sub-basins have been generated and disseminated in the form of data and information, and therefore a better understanding of the Nile Basin under future climate change scenarios.	The service is readily available and held with Nile-SEC;
P4	Flood early warning for Eastern Nile	These are flood early warning products and other related information such as operational extreme flood forecasts for the Eastern Nile sub-basins.	Electronic e-publication developed by ENTRO ● http://entro.nilebasin.org/) and email ● http://115.124.114.193:8100/rmsi_nile-	Reservoir, spillway, and dam owners & managers; Disaster risk (Flood and drought warnings) managers; Water	The service provides flood data and (quality, relevant, accurate & useful) information. The data is generated through hydrological and hydrodynamic modelling; although limited in scope, it does have user and/or problem-specific products which are aggregated and contextualized to serve flooding problem in the Eastern Nile	The service is readily available and held with ENTRO

			basin/en/flood-monitoring ● (entro@nilebasin.org)	resources planners etc.		
P5	Nile Basin River Flow forecasting system.	This is a hydrological service-decision support tool for providing daily and seasonal forecasts flow at 80 selected locations and forecasted rainfall over sub-basins to help with water resources operations and management in the Nile Basin. Agricultural and hydropower information are also available. Forecast could be sent to selected emails.	Bulletins (Publication). ● NBI website (https://nilebasin.org/) ● http://115.124.114.193:8100/rmsi_nile-basin/en/flood-monitoring ● http://13.80.108.118/ ● Email: nbisec@nilebasin.org	Water Authorities; Reservoir, spillway and dam owners & managers, Underground /borehole owners; Disaster risk (Flood and drought warnings)	Forecasts of future river conditions are produced routinely for many sites in real time so that hydrometric data and information is acquired for co-ordination of action and interaction within the system or between users. It will also involve software application, including conceptual and mathematical models in order that timing and severity of flood conditions may be predicted, and information products developed to design specifications of the Nile Basin. They shall be standardized climate & hydrological information such as short to long range river flow forecast system. Short range (up to 10 days lead time) and medium to long range (season) river flow forecast systems.	The service is planned and to be held with Nile-SEC;
P6	Drought forecasting system	This is to provide drought early warning and other related information such as operational extreme drought forecasts for the Eastern Nile sub-basins. Bi-weekly bulletin.	https://www.floddroughtmonitor.com/home http://115.124.114.193:8100/rmsi_nile-basin/en/flood-monitoring	Dam operation and irrigation specialist; dam owners; Disaster risk (drought warnings) managers;	The service provides drought data and information (quality, relevant, accurate & useful). The data is generated through hydrological, weather and climate modelling; it does have user and/or problem-specific products which are aggregated and contextualized to serve specific locations within the	The service is planned and to be held with Nile-SEC & ENTRO;

				Water resources planners etc.	Nile Basin where: Seasonal forecast for drought forecasting by suitable indices for hydro and met drought; drought indicators in near real-time and for seasonal forecasts including precipitation based indices, soil moisture indices, hydrological indices; and Web mapping of summary statistics and o other capability to view drought indices result and to generate drought bulletins	
P7	Climate proofing guidance hub for infrastructure and basin planning.	This tool will provide a step-by-step guidance for climate proofing of water related infrastructure in the Nile Basin. It provides orientation for project developers, designers, and operators for the integration of climate change in planning, designing and operation of water related infrastructure into NBI's Project Cycle. The guideline focuses on investments (project level) in the water sector, including both planned and already existing projects. The guideline can be used for a wide range of water sector projects such as flood protection infrastructure, water supply and/or sanitation systems, irrigation, and hydropower.	Bulletins (Publication). ● NBI website (https://nilebasin.org/)	Flood protection managers; Risk assessment and project managers; Regulators and funders of infrastructure systems such as water supply and/or sanitation systems, irrigation and hydropower, etc;	The user is guided step-by-step through the process of the risk assessment (i.e. risk assessment, risk treatment and monitoring and evaluation) for the relevant stage of the NBI project cycle (i.e. project identification, preparation, resource mobilization, implementation operation). Instructions and hints are provided on the selection of appropriate data and methods to be applied for specific analysis. The output is a completed risk assessment of the infrastructure object/system of concern comprising the current and future risk of critical components as well as recommendations on adaptation. This information is the basis for the integration of climate change in the process of planning, designing and operation of specific water infrastructure objects;	The service is planned and held with Nile-SEC

					Sectoral basin planning and regulation and funding of infrastructure systems.	
P8	Nile Basin Decision support tool	The Nile Basin (DSS) is an analytical tool to be used as a framework for understanding river system behavior, evaluating alternative development and management strategies, and supporting informed decision making.	Web interface, Software and Bulletins (Publication). NBI website (https://nilebasin.org/) Online licenses available for NB stakeholders. DSS Web service: https://watertools-portal.azurewebsites.net/portal/login/users/b20361a5-d080-4c39-9580-c7fafdbee650	Water resource planners, Institutional managers, Policy makers,	The DSS is a computer-based platform designed to meet the requirements of complex water resources planning with a diverse set of tools for data processing, modelling, scenario management, optimization and multi-criteria decision making with special consideration of quality, relevance, applicability, etc. It offers tools for integrating environmental, social, and economic objectives thus greatly facilitating multi-sector water resources planning at river basin level. It is a generic system that can be applied at different scales – at national as well as trans-boundary levels. It can be installed both within an institutional setup, thereby allowing multiple access to its central database and toolset, and also as a standalone solution.	The service is readily available as online licenses and held with Nile-SEC although the web service is planned.

P9	Climate Service portal	This is a planned climate service channel through which other services can be held within one portal for multiple purposes including communication and outreach. The portal shall be developed by the NBI and integrated in IKP	Web interface, Software ● NBI website (https://nilebasin.org/) ● http://115.124.114.193:8100/ikp/	Water resource planners; Institutional managers; Policy makers; researchers and academia; infrastructure operators and developers etc.	Although it is not yet functional, it is expected to be integrated with IKP where there will be eased to download data, data and information visualization components through web development etc.	The service is planned and will be held with NILE-SEC, ENTRO
P10	Policymakers & Technical Experts Awareness-raising Products	These are communication and outreach products to inform targeted groups for example policy and/or technical experts associated with or working within the Nile Basin, which may include: State of Basin Report (SOB) and the Nile Basin Atlas	Publications (Reports, briefs, videos, etc.) media; etc. ● NBI website (https://nilebasin.org/) ● Announced via email with shared links on Google drive e.g. http://nbi20.nilebasin.org/	Policy makers; technical experts; decision makers; regulators, cooperation frameworks etc.	Depending on the target audience, a policy brief would be of max. 4-6 pages of document on the result of translating results of the NBI research and analysis work on climate services in the NBI countries; while for technical experts would be reports of various uses, relevance, access, facts, adequacy, importance, clarity, etc. Other examples may include State of Basin Report (SOB), Nile Basin Atlas, etc. It shows the range and complexity of the programmers and activities undertaken over the years as well as some of the major outcomes while proposing what lessons can be drawn to feed into future cooperation.	The service is readily available and held with Nile-SEC;
P11	Capacity building	This is training for strengthening capacity of Nile Basin national experts on water resource management and climate change	Training courses ● NBI-website (https://nilebasin.org/) and email	National experts, consultants and NBI staff	Formats of learning and training for staff and users to be able to provide or use the available services that mainly focuses on hydrological and flood modelling	The service is readily available and held

		adaptation. It is a dissemination platform of the Nile DSS mainly using the electronic platform for information management, analysis of water resources, internal learning and also tailor-made face to face training.	• Web interface and online instructors; Register, Login and enroll for the NBI induction; Training; software tools;		and climate change scenario selection and analysis	with Nile-SEC;

8.6. Conclusions And Recommendations on the CSC

The NBI product portfolio on climate services consists of eight (8) readily available products and another five (5) products that are either under development or planned. Two (2) of the readily available products may be classified as auxiliary products which are needed in the development or continued operationalization of some of the existing products. The services portfolio has been summarized in tabular form **(Error! Reference source not found.)**; with each product given more detail and presented in poster form. The products and/or services have been grouped or categorized as: Hydrological and Meteorological Systems, Climate Change and Hydrological Scenarios, Hydrological Modelling and Forecasting, Decision-Support Tools, Climate Service Communication & Outreach, and User Support & Training.

The NBI CS-products portfolio and categorization does fit relatively well within the climate services value chain with some products serving simply as raw or model data which is used as input to develop other products for multipurpose use or tailoring them for specific use. Others are there to address specific user needs or may be aggregated and contextualized into different climate & hydrological information to serve a specific problem or tailored for a specific user type and location. It is also noted that there is a variety of products and services used to enhance usefulness and usability, such as to turn data into information, support the process of tailoring and contextualizing to get user problems and specific climate information. Lastly, the climate services catalogue shall improve on outreach and awareness of available products but also to identify areas that are lacking and need improvement; and this may be done through the Climate Services Action Plan. For example, the NBI will need to adapt to various digital platforms (e.g. various social media platforms) beyond its current website to facilitate the sharing of data and information including facilitating an easier and quicker way to get information out there to the end-user; although for this CS catalogue, the website remains an able platform to get out the desired information.

The NBI climate services catalogue should harness (in collaboration with NHMS) opportunities presented by these products while working on limiting the challenges. Herein is what is recommended going forward:

- *The NBI should use the services and/or networks of their different associate national bodies (especially the NHMS) to further help coordinate the compilation, production, proof reading and distribution of the catalogue but equally, the national entities shall be tasked with ensuring that the data and information used to produce the catalogue is continually up to date and authenticated, which will help accelerate the implementation of CS at regional and national levels. This would also encourage co-production of similar areas of work to improve quality, distribution, data and information sourcing, etc.*

- *Increase specific application of products to different user groups and locations by exploring various options to tailor the products to specific user type and location.*

- *Improve on costumed tailored information for other specific applications and multipurpose use by exploring other ways of knowledge and use transfer beyond the current means presented by the available products.*

- *Provide justification for the application of a given CS product with visible results to a particular user or location etc. such that such a user sees improvements in decisions because of using a said CS product.*

- *To optimize the full functionality of hydrological monitoring systems by ensuring the network meets the required networks density, operational standards and operating well.*

- *Increase reliability and performance of the data from Nile Basin Hydrological Monitoring System by enhancing the process of turning data into information to ensure that the data collected and stored meet standard data*

formats, quality and quantity levels, etc.; and also that there are standard guidelines and workflows, tools, scripts, etc. to ensure proper use.

- *To optimize the full use of possibilities within this product range of hydrological monitoring system by understanding current use and then widening scope of use; and*

- *To proceed to develop the Climate Services Action Plan and Workflow manual as a follow-up to this Catalogue such that some of the above recommendation may come to fruition.*

8.7. References to the Climate Services Catalogue

GIZ (German Development Cooperation-2018), https://www.adaptationcommunity.net/download/climateinformation/Report-Climate-Services-Germany-Carolin-Frisch.pdf

GFCS (Global Framework for Climate Services-2009), http://www.gfcs-climate.org/what-are-climate-services/

NBI (Nile Basin Initiative-2013), Climate Change Strategy in 2013, https://nilebasin.org/transboundary-policies/49-climate-change-strategy/

WMO (World Meteorological Organization -2014), Climate Services for Supporting Climate Change Adaptation, https://library.wmo.int/doc_num.php?explnum_id=7936

WMO (World Meteorological Organization -2018): Step-by-step Guidelines for Establishing a National Framework for Climate Services. Geneva, Switzerland. http://www.wmo.int/gfcs//step-by-step-guidelines-nfcs

ONE RIVER
ONE PEOPLE
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Nile Basin Initiative Secretariat
P.O. Box 192
Entebbe – Uganda
Tel: +256 414 321 424
+256 414 321 329
+256 417 705 000
Fax: +256 414 320 971
Email: nbisec@nilebasin.org
Website: http://www.nilebasin.org

/Nile Basin Initiative
@nbiweb

Eastern Nile Technical Regional Office
Dessie Road
P.O. Box 27173-1000
Addis Ababa – Ethiopia
Tel: +251 116 461 130/32
Fax: +251 116 459 407
Email: entro@nilebasin.org
Website: http://ensap.nilebasin.org

ENTRO

Nile Equatorial Lakes Subsidiary Action Program Coordination Unit
Kigali City Tower
KCT, KN 2 St, Kigali
P.O. Box 6759, Kigali Rwanda
Tel: +250 788 307 334
Fax: +250 252 580 100
Email: nelsapcu@nilebasin.org
Website: http://nelsap.nilebasin.org

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