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Foreword by the Secretary

Executive summary

WMO Capacity Development Strategy (CDS)

1.1 Introduction

The World Meteorological Organization (WMO) has been providing essential worldwide leadership and coordination in weather, climate, water, and related environmental data and services for over a century. The WMO is working to increase the capacity of member nations to identify and reduce the risks associated with an increasing number of natural disasters. Anthropogenic climate change has increased the frequency and severity of such events, which has led to an increase in corresponding economic damages. According to the WMO *Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes* report (2020), weather, climate, and water-related hazards accounted for over 2 million deaths and US\$ 3.64 trillion in damages between 1970 and 2019.

During the same time period, however, mortality from these events have decreased, largely due to the development and improvement of disaster prevention, preparedness, and response programs. The WMO has played a critical role in increasing public awareness of weather, water, and climate hazards and fostering collaborations between meteorological services, disaster management agencies, and their governments from around the world.

WMO observational data provide large economic and societal benefits. These data are provided by space-based satellites, ground systems, and in-situ sensors. However, the value of this data is not always understood or fully recognized by decision-makers and the public. Observational data often have public good characteristics and a significant portion of the value of observational data lies outside normal markets (Harris and Miller, 2011). National governments have traditionally funded and collected observation data, such that the public can access it at minimal or no cost. This lack of a market means prices do not indicate the data's full value. Observing systems are expensive to develop and deploy, and require operational commitments sometimes spanning decades. However, recent economic assessments have found positive cost-benefit ratios for investment in weather and climate services, typically around 1:4 – 1:36 (Kull et al., 2021). More fully incorporating impacts of observational data on people's daily life will likely reveal these ratios are underestimates.

The WMO works to fully exploit the potential benefits of observational data by ensuring effective international exchange. Many countries cannot afford the infrastructure and human capital costs of setting up and maintaining a high performing hydro-meteorological service. This had led to patterns of missing observational data that correlate strongly with nation income (GDP per capita). This capacity constraint is the focus of this report. This lack of data sharing leads to inefficiencies and less accurate Numerical Weather Prediction (NWP) systems. NWP models require global data to produce their estimates and forecasts. National Meteorological and Hydrological Services agencies (NMHSs) in low- and middle-income countries often do not have the information they need to conduct high resolution models and often use global NWP data. Thus, it is crucial for these NHMSs to collect and share their observational data with the global NWP community.

Whether the lack of data sharing is due to a country not collecting the information, or an unwillingness to share the data that has been collected, the lack of data affects every nation's ability to produce accurate and reliable weather and climate forecasts. Value from observational data is only realized if that information is used in a decision-making process. Thus, investing in the infrastructure and human capital

necessary to ensure the sharing of observational data, the processing of data into information, and the use of that information in some decisions is critical. When observational data is collected and freely shared from all member countries and used and communicated effectively, the objectives laid out in the Sendai Framework for Disaster Risk Reduction, the 2015 Paris Agreement, and the Sustainable Development Goals become more attainable.

While progress has been made, large gaps in weather observations persist, largely from Least Developed Countries (LDC) and Small Island Developing States (SIDS), which threaten the accuracy and future development of early warning systems. Improving environmental monitoring and early warning systems is foundational to meeting the objectives laid out in the Sendai Framework for Disaster Risk Reduction, the 2015 Paris Agreement, and the 2030 Sustainable Development Goal Agenda. The WMO is committed to improving the capacity of local and national governments and NMHS around the world for this purpose.

Increasing the capacity of governments and NMHS to accurately forecast and predict weather, water, and climate hazards is one of the WMO's core missions. Managing climate risks and making informed decisions is largely based upon the forecasts and climate analyses produced by global-scale NWP systems. These systems require quality, real-time observational data in order to be useful, which requires member nations to produce and share this information promptly.

Since weather, climate, and water cycles know no national boundaries, international cooperation is crucial to protect all member nations. The sensitivity of the national economies of many LDC and SIDS to natural hazards have revealed major capacity gaps. The sharing of science-based information and economic resources to build and maintain the necessary institutional framework, infrastructure, and human capacity to transform and communicate observational data and information for decision-making is crucial for reducing the impact of weather, water, and climate hazards. Capacity development is the cornerstone for ensuring LDC and SIDS have the knowledge and resources needed to navigate the challenges of a changing climate and better protect, mitigate, and recover from natural and human-made environmental disasters. The WMO capacity development strategy provides the framework for this international collaboration.

Why capacity development?

Capacity development (CD) is the process of strengthening the capabilities (or capacities) of individuals, organizations, and societies over time to solve problems and sustainably meet their social and economic goals. Many LDC and SIDS lack the economic resources to provide and sustain high-quality hydro-meteorological services. CD can help WMO members fulfil their mandates and contribute to WMO goals, while also increasing their resiliency towards weather, water, and climate hazards. It is a critical mechanism that makes WMO's mission possible and has been responsible for much of the WMO's progress thus far.

What is the WMO?

The WMO is a specialized agency of the United Nations with 193 Member States and Territories. It is the UN's authoritative voice on the state and behavior of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces, and the resulting distribution of water resources.

The WMO's Vision:

By 2030, we see a world where all nations, especially the most vulnerable, are more resilient to the socioeconomic consequences of extreme weather, climate, water and other environmental events and

underpin their sustainable development through the best possible services, whether over land, at sea, or in the air.

The WMO's Mission:

Under Article 2 of the WMO Convention, our mission is to facilitate worldwide cooperation on monitoring and predicting changes in weather, climate, water and other environmental conditions through the exchange of data, information and services, standardization, application, research and training.

CD is an endogenous process involving multiple social, political, and technical considerations across multiple stakeholders across multiple levels of society: individual, organizational, national, and regional (FAO, 2010). CD often focuses on education and training programs for the transfer of knowledge and skills to member nations but is also considered a complex, long-term sustainable development strategy. Done well, CD can address the specific needs of member countries but also expand in non-linear ways to other areas of need.

The WMO distinguishes between “capacity building” and “capacity development.” CD builds upon existing local capacities, whereas the former assumes that none exist. Whereas capacity building was based on external resources, power, and plans, CD is endogenous: change is based on augmenting local knowledge and resources, to ensure compatibility with and buy-in from members of the host society (FAO, 2010). Effective CD includes all those who can affect and be affected by a development or training program and generates a high degree of local and national ownership of the CD process. By using the term “capacity development,” the WMO acknowledges that existing local knowledge, needs, and goals must inform its assistance to national and local governments.

Capacity development supports the communication and sharing of knowledge. Advanced hydro-meteorological services can be provided to communities in developing countries by drawing on shared data and knowledge within the region and from global institutions. As data and information increase, sharing that knowledge can help improve NHMSs and local and national governments’ effectiveness. Building and maintaining cooperative relationships and the basic human and physical infrastructure needed to manage these knowledge resources is essential.

Capacity development supports meaningful collaboration and effective innovation. Through CD the WMO will provide cutting-edge technology and support to member nations. It will also work with members, nongovernmental organizations, private local stakeholders, and other UN agencies and programs to develop new technology to support decision-making as well as to improve disaster response and mitigation through weather, climate and water services. Such collaboration has proven effective in the event of natural disaster in the past. Effective CD ensures these relationships exist and are well executed.

Capacity development helps bridge the gaps between developed and developing countries. Feedback mechanisms are established to ensure a “culture of compliance” with WMO standards and agreements, establish capacity baselines, and pinpoint capacity needs. Capacity development helps local and national governments and NMHSs to identify and address the capacity gaps between developed and developing countries. Defining and measuring local needs will allow the advancement of CD and will also shape the global priorities of WMO as well as those of regional and sub-regional partnerships and funding initiatives. WMO technical commissions identify gaps in terms of institutional, infrastructural, procedural and/or human abilities and form task teams and working groups to address specific plans.

Capacity development is paramount to sustainable development, in particular in developing countries and regions. Sustainable development requires local institutions to work collectively towards

societal improvements, while including mechanisms of feedback, accountability, and inclusivity. Sustainable development can address fragile systems of governance and increase resilience to environmental shocks and natural disasters.

There are strong connections between CD, the SDGs, and disaster risk reduction (DRR, the purview of the United Nations Office for Disaster Risk Reduction, UNDRR): all are designed to support long-term resilience to minimize harm to the environment, economies, and human health (UNDRR 2019). CD strategies should align with both the SDGs and DRR, as well as the needs of local and national governments. These interrelationships and commonalities should be enhanced and fully leveraged.

Capacity development and the SDGs. The 17-part 2030 Sustainable Development Goal Agenda outlines an ambitious plan to increase environmental sustainability while also increasing sustainable economic development—pursuing economic growth within planetary boundaries while leaving no one behind. Many countries, particularly LDC and SIDS, will need new and increased capacities in order to meet them, and even in well-resourced countries partnerships and collaborations within and across countries will be required. New capacities must be developed for individuals, communities, countries, and entire regions to ensure the principles and goals laid out in the SDG Agenda are institutionalized. This is especially true for LDC and SIDS and for historically underrepresented and underserved communities that require additional support.

Sustainable Development Goal Target 17.9 specifically calls for capacity development and aims to “Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South, and triangular cooperation.” The 2030 Agenda also addresses the means by which LDC and SIDS are expected to meet the SDGs, which include the mobilization of financial resources at favorable terms, and the sharing of environmentally sound technologies. In return, LDC and SIDS are expected “to strengthen their national institutions to complement capacity-building” and “ensure the inclusion of capacity-building and institution-strengthening, as appropriate, in all cooperation frameworks and partnerships...within their existing mandates and resources.”

The SIDS Accelerated Modalities of Action (Samoa) Pathway also establishes CD as a key tool in achieving its SDGs for Small Island Developing States. The Samoa Pathway is a set of commitments first made by 115 SIDS leaders at the Third International Conference on SIDS held in Apia, Samoa from September 1-4, 2014. These goals include poverty eradication, promoting sustainable patterns of consumption and production, and protecting and managing the natural resource base for economic and social development (UN, 2014). While SIDS have made a historically negligible contribution to the causes of climate change, the effects of climate change often hurt them first and worst and they typically have limited economic resources to cope and respond to these challenges. CD provides a mechanism to reduce the vulnerability of SIDS to the effects of climate change.

Capacity development and the Sendai Framework. The Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework) aims to reduce global disaster risk. Effective DRR requires an all-of-society approach and necessitates the sharing of responsibilities between national governments and stakeholders at the local level. Capacity gaps have arisen from the establishment of the goals, targets and indicators used to measure progress of the framework. UN Member States have declared that without capacity development and support, achieving the Sendai targets will be impossible. The Sendai Framework utilizes CD as a core strategy to implement more collaborative and coordinated efforts to meet technical support requirements and increase local resources to meet the DRR targets. Despite significant gains in reducing mortality associated with climate disasters, significant disaster risk remains, especially in LDC and SIDS. Further progress on DRR will be limited until stakeholders from all sectors and levels of government understand the capacities needed to perform the actions required, the gaps that remain, and what is needed to close them (UNDRR 2019).

Capacity development and the 2015 Paris Agreement. The Paris Agreement also stresses the importance of CD and argues that it should be country-driven, based on countries' needs and priorities, and foster country ownership. LDC and SIDS each have their unique capacity gaps and achieving the goals of the Paris Agreement will require enhanced cooperation, including scaled-up financial and technology transfers to mobilize and strengthen developing countries' capacities (Dagnet et al., 2019).

Why now?

This report updates the 2015 WMO Capacity Development Strategy (CDS) to reflect and adapt to the new WMO Priorities, Strategy, and Governance, which was set forth by resolution XX from the XX Congress, which recognizes CD as one of the strategic priority areas expected to make a significant contribution to the achievement of WMO targets and goals. CD is often a long-term process and WMO is committed to working with its partners and member nations to systematically and incrementally build capacity across dimensions and continue to follow up and provide support. This strategy updates WMO's approach towards CD and ensures that the changing needs of member countries are well met.

WMO Governance Reform

The WMO has committed to reforming its governance strategy in order to better respond to the growing global demand for weather, climate and water data and expertise. The reform has been shaped to improve the efficiency and effectiveness of WMO programs in order to efficiently use increasingly limited resources and provide optimal value to funders.

The Eighteenth World Meteorological Congress adopted the previous strategic plan (2020–2023) in June 2019, and it is typically reevaluated and adopted every four years. To ensure that the WMO maintains its leadership role and remains fit-for purpose, a streamlining of the WMO's structure was recommended to make it simpler for the WMO to enlist leading experts and the private sector in its activities (WMO, 2019). This restructuring will enhance national and regional engagement and assure that no member state is left behind.

The Seventieth Executive Council (EC-70) approved:

- the establishment of an EC Policy Advisory Committee and Technical Coordination Committee, which will launch at EC-71, and
- the WMO Policy Framework for Public-Private Engagement and created a task force to draft a high-level policy act in order to facilitate more active participation and contribution of partner organizations.

EC-70 further recommended to Congress-18:

- World Meteorological Congress – biennial meetings (ordinary and extraordinary).
- Two new technical commissions – to enable a holistic approach to setting standards:
 - Commission for Observation, Infrastructure and Information Systems (Infrastructure Commission)
 - Commission for Weather, Climate, Water and Related Environmental Services and Applications (Services Commission).
- Research Board on Weather, Climate, Water, and the Environment – a new entity to promote integration of research programs and coordinate science for services and applications.
- Scientific Advisory Panel – a new entity that will engage the world's top scientists to provide independent, forward-looking strategic advice on emerging challenges and opportunities.
- Regional Associations (RAs) – amendments to the Terms of Reference of the RAs to strengthen capacity building and amplify regional engagement.

The recommendation to the Congress was that the two new technical commissions commence their work as early as possible and that existing technical commissions active during the current financial period

(2015-2019) be disbanded at the end of a transition period (2020). The streamlined structure should permit WMO to enlist both leading experts and the private sector in its activities and it will enhance proactive regional engagement and CD.

WMO Strategic Plan

The Strategic Plan adopted by the Eighteenth World Meteorological Congress, in June 2019, sets the directions and priorities to guide the activities of the WMO up to 2030 to enable all Members to improve their information, products, and services.

The Plan anticipates an increased demand for meteorological, hydrological and climatological services and embraces a new comprehensive vision for the Organization: “By 2030, we see a world where all nations, especially the most vulnerable, are more resilient to the socioeconomic consequences of extreme weather, climate, water and other environmental events; and underpin their sustainable development through the best possible services, whether over land, at sea or in the air.”

It also sets three overarching priorities – enhancing preparedness for hydro-meteorological extremes, supporting climate-smart decisions and enhancing socioeconomic benefits of related services – with a view to contributing to the societal needs reflected in the global agenda to realize sustainable development.

The strategic plan recognizes the demand for actionable, accessible, and authoritative science-based information to address the increasing threats of extreme weather and the urgency of climate action for resilience, mitigation and adaptation, as well as the need to reduce the growing capacity gap in infrastructure and services by making use of rapid advancements in science and technology and innovative partnerships.

Goal 4 of the strategic plan focuses on CD. It states that WMO shall work to close the capacity gap on weather, climate, hydrological, and related environmental services by enhancing service delivery capacity of developing countries to ensure availability of essential information and services that governments, economic sectors and citizens need.

It aims to improve access to regional and global monitoring and prediction systems and utilization of weather, climate, and water information and services bringing tangible benefits to developing Members, in particular least-developed countries, small-island developing states and Member island territories. This will be achieved through strategic investments, technology transfer, knowledge and experience sharing, and by taking due account of social inclusion and gender factors.

The first objective is to address the needs of developing countries to enable them to provide and utilize essential weather, climate, hydrological and related environmental services. The increasing vulnerability of many LDC and SIDS societies and economies to natural hazards and extreme weather events require WMO to strengthen its CD efforts. This will require building upon existing capacities in NMHSs, taking advantage of the capacity of developed country NMHSs in twinning and other arrangements, and leveraging the investments of the UN system and other development partners towards this goal.

The second objective is to develop and sustain core competencies and expertise of LDCs and SIDS. There is a growing deficit in the capability and numbers of adequately educated and trained staff needed to provide weather, climate, hydrological and related environmental services in many countries and territories. Additionally, rapid advances in scientific innovation and technological developments and means for public communication require corresponding and continuous training of NMHS personnel. WMO will increase its training and long-term education activities to help Members to obtain and maintain needed competencies.

The third objective is to scale-up effective partnerships for investment in sustainable and cost-efficient infrastructure and service delivery. The WMO will work to enhance the full spectrum of the weather, climate, and hydrological services delivery to support the protection of life, property and the environment, and the security of food production, energy and water resources. This will involve scaling up partnership investments to minimize cost and maximize the opportunity for the networks to be sustainable long beyond the lifetime of donor funded projects.

This report also updates the CDS to incorporate the new WMO Data Policy, Global Basic Observing Network (GBON), and Systematic Observations Financing Facility (SOFF) initiatives.

The new **WMO Data Policy** is designed to help WMO Members maximize the benefits of free and unrestricted exchange of Earth system data. Various national and international economic analyses have demonstrated that the highest economic impact of Earth system data depends on free and open data policies and that the benefits of sharing all available Earth system data far outweighs the costs. The new WMO Data Policy requires that Members provide on a free and unrestricted basis the core data that are necessary for the provision of services in support of the protection of life and property and for the well-being of all nations. At a minimum those data which are required to monitor and predict seamlessly and accurately weather, climate, water, and related environmental conditions shall be freely shared. Members should also provide the recommended data that are required to support Earth system monitoring and prediction activities at the global, regional, and national levels and to further assist other Members with the provision of weather, climate, water and related environmental services in their States and Territories.

The collection and sharing of reliable, real-time observational data in the future is critical as climate change increases the severity and frequency of extreme weather events. The **Global Basic Observing Network** was established to collect and exchange critical surface-based observational data from all WMO members. It establishes clear requirements and obligations for all member nations to exchange data at a minimum level of spatial resolution and time intervals. Many LDC and SIDS lack the capacity to meet the GBON requirements. This decreases the entire WMO enterprise's ability to generate accurate and timely weather forecasts and climate products that inform crucial environmental monitoring and early warning systems. As a result, every WMO member nation suffers lower resiliency to weather, water and climate disasters.

Once implemented, GBON will improve the availability of the most essential surface-based data, which will have a direct, positive impact on the quality of weather forecasts, thus helping improve the safety and well-being of citizens throughout the world. Most WMO Members can implement GBON relatively quickly in the developed world. But in many developing countries additional investment and capacity development will be needed. To that end WMO will be working closely with the international development and climate finance communities.

According to the WMO's report, *The Gaps in the Global Basic Observing Network* (2020), the GBON data gaps are significant and have a substantial impact on the NWP global models. For example, the GBON has a target of 2,300 observation stations (surface and upper air) among LDC and SIDS, but roughly 87% of those stations (2,000 stations) need to be newly installed or rehabilitated. It is likely that COVID-19 pandemic has increased this data gap.

However, the economic benefits of closing the GBON data gap greatly outweigh the costs of establishing and maintaining the systems required to do so. To do this WMO has established a new financing mechanism called the SOFF. The SOFF provides technical and financial assistance to LDC and SIDS to meet their GBON requirements and obligations. Recent World Bank research has found that for every dollar invested, the socio-economic return is at least US\$ 26 (Kull et al., 2021). The SOFF is designed to assist the most vulnerable to climate disasters by increasing observational data sharing and strengthening

their climate adaptation and resilience. The WMO is leading the SOFF with partners from a wide range of international organizations.

The **Systematic Observations Financing Facility** helps countries to generate and exchange basic observational data critical for improved weather forecasts and climate services. SOFF will provide technical and financial assistance in new ways – applying the internationally agreed metrics of GBON – to guide investments, using data exchange as a measure of success, and creating local benefits while delivering on a global public good. The SOFF will help strengthen climate adaptation and resilience across the globe, benefitting in particular the most vulnerable. A wide range of international organizations, including the members of the Alliance for Hydromet Development, are collaborating on the effort. The Alliance united efforts of major development and climate finance partners to close the capacity gap on high-quality weather forecasts, early warning systems and climate information. The SOFF will start operating with an initial five-year implementation period, during which it will prioritize support to SIDS and LDC. An independent external evaluation will take place in the fourth year of the initial implementation period. The evaluation will include an assessment of the results-based funding approach to ensure that it is working as intended.

The purpose of a revised capacity development strategy.

The revised CDS provides WMO with a coordinated and cohesive approach to CD activities to help Members fulfil their mandates and contribute to the goals of the Organization. The WMO Capacity Development Strategy recognizes four types of capacity: institutional, infrastructural, procedural and human resources. These capacities must be considered collectively to achieve sustainable capacity development of governments and NMHSs. The CDS was designed to help all Members, especially NMHS in LDC and SIDS, to coordinate, standardize, improve, and encourage efficiencies in the exchange of weather, water, and climate information, and to foster its application to the needs of society. This strategy document establishes a shared WMO vision and coherent approach to CD based on a common set of principles that will guide all relevant WMO programming.

The WMO's strategic framework identifies CD as key to long-term sustainable development and progress. It must be conducted in partnership with national, regional, and global partners and remain consistent with the national and local priorities of beneficiaries. The unfolding of CD processes is often nonlinear and should be seen as an evolutionary process in which the strengthening of capacities influence one another and the enabling environment in a self-reinforcing loop (FAO, 2010).

1.2 Capacity development vision, mission, and principles

Capacity development vision

The WMO will use CD to meet the needs of governments and NMHSs to meet society's need for information on weather, climate, and water for the safety and well-being of people throughout the world.

Capacity development mission

The WMO's CD activities will facilitate a holistic and integrated approach to sustainable CD of governments and NMHS agencies, especially in developing countries, LDC and SIDSs, through advocacy, education and training; outreach, partnerships and resource mobilization; demonstration and pilot projects; service delivery; and research.

Capacity development principles

The principles below will ensure that WMO's support for CD serves the needs of local technical sectors and country and regional stakeholders, while properly prioritizing according to the WMO's mission and mandates. They will also ensure coherence across the range of countries WMO serves.

Principle 1: Integrated and holistic approach to data and services

The WMO's work has undergone a strategic shift to emphasize integration. The "Earth system" treats the Earth as a single system, linking land, air, water, cryosphere and even the biosphere. The ever-increasing amount of scientific knowledge that stems from emerging technology requires deliberate efforts to create such integration. It is designed to prevent silos such that various research fields are connected to each other and to service agencies and policymakers.

Ensure that data from various providers (e.g., commercial, private/public, non-NHMS sectors) and sources (e.g., in-situ and space-based) are available to decision-makers as required.

The activities that constitute the WMO's work include (i) observations, (ii) information exchange and data dissemination, (iii) data processing, and (iv) service delivery. In line with this progression, end-user requirements for service generally determine the shape of observing systems; the WMO Integrated Global Observing System (WIGOS) has been developed with this in mind. It is designed to ensure that observation gathering is efficient, cost-effective, and sustainable and that it produces observations that are dense and high-quality. Implementation of WIGOS focuses on integrating governance and management mechanisms, functions and activities among the contributing systems. This includes ensuring interoperability and compatibility as a crucial basis for meeting the needs of diverse users. This includes standardizing data as well as the instruments and methods of observation across all components to meet internationally accepted standards and best practices. Attention will be paid to surface-based and space-based elements (observations and their metadata); WMO Information System (WIS) exchange as well as discovery, access and retrieval services, and data management (data processing, quality control, monitoring and archiving).

Ensure that services are reaching the required and intended end-users across all application areas (beyond those governed by NHMSs).

WIGOS is a key factor in WMO's ability to fulfill its mandate to support Members and their partners through education, training and capacity development and in addressing natural hazards; improving weather, water, and climate; conducting environmental monitoring; and adapting to climate change impacts. It does this in part by issuing observing standards and recommendations that lead to high quality observational products and information. These standards and recommendations support infrastructure for effective climate, water and related environmental services.

Only governments, NHMSs, and their national and international partners can supply the comprehensive and coordinated observing mechanisms to ensure the delivery of high-quality climate, water and related environmental services. WIGOS meets this need by providing compatible, quality-assured, quality-controlled and well-documented long-term observations.

Ensure an end-to-end seamless approach from observation/data providers to services/final end-users.

WIGOS is based on a composite network design that will aid in supplying data about areas where data is sparse. An approach that integrates and optimizes observing networks, technologies, and processes into a network of networks that provides full coverage of required observations, including planned redundancy for key measurements, and engages the wider community of institutions monitoring the environment is ideal for WMO Members. This will maximize the value of data from all sources.

Members will also benefit from comprehensive monitoring that will balance traditional and innovative approaches to provide the advantages of recent innovation while still maintaining data from the historical record. User needs will be balanced with operational and technical constraints to achieve quality, reliability, and representativeness. Tiered networks will facilitate the integration of externally contributed networks and observations and aid data users in matching observing solutions to needs.

Partnerships and cooperation will be vital to extracting the benefit of satellites as they evolve to fill current data gaps and provide more of the observations needed to support required meteorological, hydrological, and oceanographic services. Satellite data cannot fulfil such needs without national capacity to operate observing systems. Partnerships across borders, disciplines and organizations will be key.

Principle 2: Encourage country ownership and work with existing systems.

Governments and NMHSs will engage in development activities, articulate clear CD targets, and define CD strategies based on Member countries' own development processes. The WMO will incorporate the needs and goals of existing stakeholders when generating the initial intervention and executing the project through national actors, systems, and processes.

Before starting a CD project, WMO will learn how the national observation system currently functions, attending to its context, capacity, and key stakeholders, the relationships among them, and these relationships' impact on the system. WMO will consider the social and geographic dimensions (sub-national, national, regional, global) that determine which stakeholders are relevant to key CD objectives.

CD efforts and performance improvements will be based on current system functioning and the roles and relationships of key stakeholders. The priorities of local actors will guide capacity development which will allow for long-term development and increased resiliency.

Consider existing systems and capacity when designing programs. This means applying culturally relevant adult learning approaches that foster an appreciation for lifelong learning, offering safe learning environments and respect for learners.

Recognizing that disparate organizational capacities are interdependent will also guide WMO's CD approach. An organization's identity, culture, leadership and management systems, and ability, function and performance all affect performance. When change is needed, it will only be sustainable if it comes from within and is based on new learning by organizational actors. It also typically takes time.

At the network level, effective capacity development strengthens coordination between multiple actors. Supporting effective relationships involves building social capital. At the same time, organizational actors within a network must define their own ways of cooperating, managing conflict and complementing each other's actions.

Principle 3: Allow local priorities to guide capacity development and utilize existing local capacities.

Embrace and leverage the priorities of local actors. Effective CD interventions prioritize national needs and goals. Decisions about which capacities to strengthen, which approaches can be most effective, and what performance improvement targets to set must be grounded in the desires and aspirations of local actors. When local actors value and have a stake in change, it is far more likely to succeed and to be sustained over time.

Over time donor priorities can undermine a CD mission by diverting scarce resources. It can also increase international dependency and weaken resilience by stifling national support networks and revenue

generation. Strengthening CD will require emphasizing the areas that WMO and local actors jointly see as most valuable for their performance, irrespective of donor priorities.

Build on the strengths of the existing system. Effective and sustainable CD requires approaches to assess local actors' existing assets, including skills, positive relationships, local leadership roles, trust and legitimacy, social cohesion, and/or effective practices.

Principle 4: Establish feedback mechanisms that build trust with local partners and encourage equity and inclusion.

WMO will embrace two types of feedback mechanisms. The first depends on development actors from the UN, middle-income countries, global funds, the private sector and civil society organizations. All have been increasing their contributions and bringing valuable experience to CD. In implementing feedback mechanisms with these actors, WMO will make harmonization more effective and embrace inclusive partnerships so that efforts have greater impact on increasing CD.

The second feedback mechanism involves considering local norms, objectives, capacities, and values, which WMO and partners will embrace. Such mutual learning will build WMO capacity and make possible a best fit approach. Partnering with local actors in monitoring, learning, and adaptation will take a variety of forms. These include co-creating theories of change and indicators such that they reflect a vision of success that resonates locally and jointly interpreting data and prioritizing areas for program adaptation.

Build trust and encourage inclusion and equity. WMO must use methods that avoid conflict and ensure that CD programs do not exacerbate inequalities, and if possible, reduce social imbalances and elevate marginalized groups. Each individual is responsible for the transformation of their own system and society and an effective CD strategy should enhance equity and inclusion.

1.3 The four dimensions of capacity development

The WMO Capacity Development Strategy focuses on the following dimensions:

Dimension 1: Institutional capacity.

Institutional capacity refers to the capability of governments and NMHSs to (a) articulate their mandate, elaborate their management structure or envision the desired course of the organization; (b) develop a strategy, translate it into an actionable plan and prepare a budget; (c) engage with stakeholders to identify and create consensus around CD issues and related policies, regulations and laws that enable effective provision of services.

Dimension 2: Infrastructural capacity.

Infrastructural capacity refers to the capability of NMHSs to access the resources needed to generate, use and archive weather, water and climate data and to access tools relevant to decision-making, such as observing networks, data management systems, computer hardware and software, internet, manuals and scientific literature.

Dimension 3: Procedural capacity.

Procedural capacity is the capability of NMHSs to define and advance best practices for generating and using weather, water and climate information. This includes the processes needed to carry out projects, programs or policies, to monitor their implementation and to evaluate results.

Dimension 4: Human resources capacity.

CD requires individuals equipped with the education, skills, knowledge and training that enable them to generate, communicate and use weather, water and climate information for effective decision-making.

These four dimensions are distinct and yet interrelated. While highly technical human resources and infrastructural capacities have been relatively well addressed during the long history of WMO technical cooperation, procedural and institutional capacities are also required to implement and review policies, strategies, programs and projects. A suite of management and leadership skills need to be added to human resource capacities to enable NMHSs to build stronger national political ownership, develop relevant policies and legal frameworks, and enhance sustainability by linking regional, sub-regional and national planning processes.

1.4 Strategic capacity development objectives

Objective 1: Address required capacities (and identify deficiencies).

An accurate understanding of the required capacities will help formulate appropriate capacity development responses, prioritize investments and mobilize resources. Baseline information is vital for the monitoring and evaluation of capacity development activities and for continuous improvement of operations. Requirements and deficiencies will be inferred from information relating to the compliance of NMHSs with WMO standards and the service needs of different stakeholders, end users and society as a whole. In Objective 1, emphasis will be placed on guidance for defining requirements, training in service delivery and stakeholder relations, compliance with WMO standards and clarification of institutional relationships and identification of deficiencies in the delivery, use and impact of weather, climate and hydrological services.

Strategic approaches:

- 1.A: Ensure compliance with WMO technical requirements to address priorities.
- 1.B: Assist countries in identifying deficiencies of governments and NMHSs.
- 1.C: Encourage development of services to address specific user needs.
- 1.D: Establish modalities for engaging partners and stakeholders.
- 1.E: Encourage and highlight diversity, inclusion, and equity.
- 1.F: Ensure access to required data (which may go beyond “core” data per new Data Policy)

Objective 2: Increase visibility and national ownership.

The enabling environment needed to ensure sustainable development of NMHSs depends on national ownership. The CDS will foster closer cooperation between government ministries and departments in charge of NMHSs and those sections of government responsible for setting national priorities, in order to secure political buy-in and goodwill towards NMHSs. Through these efforts, Members will recognize the national and international significance of investing in NMHSs, as part of the development priorities reflected in their National Development Plans (NDPs) and Poverty Reduction Strategy Papers, and, in essence, demonstrate the ownership and commitment needed for sustainable development of the NMHS.

Socioeconomic benefits will be emphasized so that NMHS engage in a strong and long-term partnership with their governments, thus securing national ownership of the requirements, benefits and deficiencies. This is particularly important given current trends in development financing, which emphasize alignment with the priorities of governments as reflected in NDPs or Poverty Reduction Strategy Papers, to attract domestic and external funding.

Coordination amongst partners will be strengthened to avoid duplication and foster the sharing of resources. This coordination is needed to develop, mobilize and harmonize investments to increase the capacity development of Members' NMHSs. In-country engagement of NMHSs with stakeholders will be seen as part of a wider process of strategic management and an integral part of developing capacity through clear institutional arrangements, roles and responsibilities, and national ownership.

Strategic approaches:

- 2.A: Explain to decision makers the socioeconomic benefits of services provided by NMHSs.
- 2.B: Assist NMHSs in incorporating national and international requirements into national policy, legislative frameworks and national development plans.
- 2.C: Enhance outreach to end users and decision makers.
- 2.D: Develop leadership and management capacities.
- 2.E: Reinforce national support to meet societal needs for weather, climate, and hydrology services.

Objective 3: Optimize knowledge management.

Knowledge management serves to improve activities across the CDS and is essential for defining requirements, needs, gaps and priorities. Knowledge management will ensure the continuous renewal of information, best practices and shared skills across WMO. Objective 3 will involve the creation of supportive organizational structures through information and communication technologies (ICTs), with emphasis on teamwork and dissemination of knowledge that can assist in capacity development. It will optimize knowledge management and foster sharing of the experiences and resources of NMHSs through regional associations, in partnership with regional bodies and entities. The use of ICTs will enable effective collaborative approaches, real-time information sharing, monitoring and feedback. Encouraging communities of practice will complement ICTs, as human interaction is essential for knowledge management. The sharing of needed skills and information will include the use of volunteers and third-party contributions.

Strategic approaches:

- 3.A: Enhance mechanisms for collecting and sharing up-to-date information relating to the development of NMHSs.
- 3.B: Share best practices and success stories relating to the development of NMHSs.
- 3.C: Enhance communities of practice dealing with the development of NMHSs.

Objective 4: Reinforce resource mobilization and project management.

Weather, climate and hydrological services are becoming core issues of development in many LDC and SIDS and funding mechanisms are showing an increased interest in investing in those services. Resource mobilization and project management assistance will be provided to developing countries to build their NMHSs. The development of a stronger regional approach will facilitate the implementation of CD activities. The institutional arrangements that enable the implementation of CD projects and programs will also be strengthened. Human resources will be enhanced to better interact with development agencies. Voluntary cooperation and bilateral assistance will also be facilitated and encouraged.

Strategic approaches:

- 4.A: Enhance coordination, actively explore new funding opportunities and develop proposals through dialogue with stakeholders and development partners.
- 4.B: Enhance capacity to develop, implement, monitor, and evaluate projects.

- 4.C: Encourage innovative voluntary and bilateral cooperation.

Objective 5: Strengthen global, regional, and subregional mechanisms.

Global, regional and subregional mechanisms are critical to the work of NMHSs. The global and regional centers of WMO, which already provide assistance and guidance in technical areas, operational data exchange and training, need to be strengthened to better support NMHSs in line with the Organization's priorities. In addition, WMO engagement through political and scientific mechanisms and initiatives will draw attention to the capacities needed to deliver the required services.

Strategic approaches:

- 5.A: Strengthen the work of global and regional centers.
- 5.B: Strengthen global, regional and subregional mechanisms to provide support for weather, climate and hydrological services.

Objective 6: Increase education and research opportunities.

Skilled individuals with competencies relevant to service delivery are essential to the operation of NMHSs. Education and research are long-term activities that build the foundation for products and services. The WMO Fellowship Programme provides important basic education for current and future employees of NMHSs in developing countries, LDC and SIDS, based on the most recent developments in science and technology of relevance to NMHSs.

Strategic approaches:

- 6.A: Improve access to and provision of fellowships.
- 6.B: Strengthen application of research findings.

2. Institutionalizing progress

2.1 Establish change management process.

Create and normalize principles for capacity development.

The WMO CDS defines a coordinated and cohesive approach to capacity development activities, which WMO should adopt in helping Members fulfil their mandates. The WMO CDS facilitates a long-term change management process aimed at mainstreaming principles for local capacity development that advance local ownership and sustainability. To institutionalize the policy across all WMO programming, key stakeholders will carry out a comprehensive set of required actions.

CD theory of change

A CD theory of change provides stakeholders with a common understanding of why a desired change is needed and how that change should occur in a particular context. The theory of change also provides a valuation road map, mapping how value is created along the change process. This conceptual framework provides identifiable and realistic targets and helps to identify the important stakeholders in the process. Mapping the theory of change can identify proposed responsibilities, actions, and expectations to ensure they conform to the overall CD goals.

[Figure here]

2.2 Strategic framework

The capacity development process and dimensions.

An analysis of WMO assistance to NMHSs resulted in the identification of a number of issues, which led to the formulation of the strategic objectives and strategic approaches described above. The strategic objectives and strategic approaches, together with the identified activities and associated implementation plans, are expected to create an enabling environment, which will ensure that capacities are sustainable and retained over time. Each of the strategic objectives corresponds to one or more of the eight steps of the CD process and deals with the identified issues. The strategic approaches will show how the capacity development objectives described above can be achieved.

STEP 1: Define requirements.

In Step 1, the NMHS identifies what services and products are required at the global, regional and national level and what it needs to meet these requirements in terms of its institutional set up and mandate, technical skills, infrastructure, relationship with users and ability to perform its functions. The requirements may vary: they may relate to technical systems, standards or organizational set up, and can be expressed in a number of ways such as type of measurement; coverage, frequency, timeliness and resolution of observations; staffing skills and budget. They all relate to the capacities needed to provide stakeholders with the necessary weather, climate, water and related environmental services such as observations, data management, prediction, communication and data exchange. Requirements can also refer to the quality of services and their usability, availability, reliability, supportability, testability and maintainability. In this step, NMHSs should consider tailoring their products and services to the needs of users and integrating regional requirements – a key element for coordination and advocacy, as recommended by Resolution 49 (Cg-XVI).

STEP 2: Establish a baseline.

Assessing existing capacities such as procedures, institutions, human resources and infrastructure is essential. “Capacity Development that is not rooted in a comprehensive study and assessment of the pre-existing conditions will be restricted to training alone, which will not facilitate sustained results” (UNDP Strategic Plan 2008-2013). As recommended by Resolution 49 (Cg-XVI), assessing the capabilities of Members and improving their compliance with WMO standards are two aspects that need to be considered in this step. The national baseline also includes the ability of the NMHS to meet the full range of requirements identified in Step 1.

STEP 3: Analyze gaps.

Step 3 aims at comparing what the NMHS has with what it needs to meet national and international requirements. It involves determining shortcomings in terms of institutional, infrastructural, procedural and/or human capacities.

STEP 4: Develop a strategic plan.

Strategic planning is the process of identifying an organization’s or company’s long-term or overall aims and interests and the means of achieving them. A strategic plan helps an NMHS to clarify its goals, specify the measures to be taken to fill the gaps in its capacities and make decisions about resource allocation. Generally speaking, a strategic plan deals with the following key questions:

- What do we do? (mission);
- Where shall we be in the next three to five years? (vision); and
- How are we going to make it a success? (strategy).

To ensure a sustainable approach, the strategic plan should be aligned with the priorities of stakeholders, including national development plans (see Step 5), and linked to resource mobilization (see Step 6). The strategy should lead to a budget for the activities in the plan and should include sub-programs (observations, communications, staffing and services) with related targets, staff requirements with salaries and training, capital equipment and operating funds (see Step 7).

STEP 5: Ensure national ownership and support.

The development of NMHSs must be integrated into national priorities and linked to regional and global priorities to ensure its sustainability. This can be achieved through engagement with national governments, regional authorities and related institutions. Multilateral and bilateral assistance are very important, but ownership of the goals, priorities and long-term funding must be evident at the national level. A National Development Plan, shared funding or some form of government endorsement are sought at this stage to implement the strategy defined in Step 4. Resolution 49 (Cg-XVI) recommends ensuring national ownership and consistency with National Adaptation Programmes of Action and other national development plans.

STEP 6: Mobilize resources.

Step 6 stresses the need for NMHSs to mobilize financial and in-kind resources to meet the requirements identified in Step 1 and prioritized in Step 2. National support means, to some extent, national funding. As the cost of developing modern NMHSs can be a challenge for developing countries, external funding is essential. Multilateral and bilateral funding mechanisms exist and should be sought by WMO and Member countries. Resolution 49 (Cg-XVI) emphasizes international, interregional and bilateral cooperation. Volunteerism from better resourced Member governments and NMHSs should also be encouraged to extend the resources available to developing countries.

STEP 7: Implement a capacity development response.

A CD response is needed to align the strategy with national and donor strategic priorities and available resources. The implementation of a capacity development plan requires clear responsibilities, funding sources and mechanisms for coordination and management of the whole process. Goals, expected results and key performance indicators should be incorporated into the implementation plan or national budget so as to enable the monitoring and evaluation phase (Step 8) to adequately reflect progress.

STEP 8: Monitor and evaluate.

Evaluation of CD promotes institutional arrangements, leadership, knowledge and accountability. This step defines the process of monitoring and evaluating capacity development activities, not only at the end of the implementation phase but throughout the process at defined intervals. Stakeholders and partners involved in Steps 1–3 will need to take part in the development of the plan when it is put forward for approval and funding. Those involved in national planning and finance must add budget realism to the preparation of a capacity response, which may feed back into the definition of requirements. All players in the process have a role in monitoring and evaluating the implementation of the capacity development response. Responding to urgent needs in emergencies is a crucial aspect of capacity development in LDC and SIDS. The eight-step process will be applied where possible, but priority is given to a rapid response and to the implementation of a capacity development plan based on previously identified requirements and baseline, and on a gap analysis, with expedited planning, national commitment and resource mobilization.

2.3 Establish policy implementation requirements.

Key stakeholders will carry out a comprehensive set of required policy actions.

Quality management strategy.

The World Meteorological Organization encourages NMHSs to implement a quality management system (QMS) and has defined a Quality Management Framework (QMF) to provide advice on development and use of QMSs for meteorological and hydrological organizations. The ultimate goal of a QMS is to encourage and support the continuous improvement of products and services through quality control, quality assurance and quality improvement of the organizational processes. The CDS process described above may be viewed as a supplement to the WMO QMF. Even if there are no internal or external requirements for an NMHS to apply a QMS, the eight-step process suggests what is needed to build and sustain the capacity of NMHSs and thus to address the requirements of national and international stakeholders.

Mechanisms to reflect WMO CDS in countries' bilateral training plans

To avoid duplication of similar subjects of training and to ensure fair opportunity to be trained

2.4 Ensure a strategic, sustained, well-coordinated approach to organizational change.

Role of WMO and its Members in the New WMO Governance Strategy

WMO Secretariat

The role of the WMO Secretariat in the implementation of the CDS includes the following:

- Developing guidance material manuals and guides to assist NMHSs in their work. This material contains standards, technical information and practical advice on data collection and exchange, policies and practices as well as specific guidance on the role of the NMHSs. This guidance material is a reference for the establishment of requirements of NMHSs.
- Assisting with country assessments. The assistance of WMO experts, or the facilitation of expertise sharing by other NMHSs, in the assessment of capacities often provides the objectivity governments and donors require in the preparation of strategic plans for the development of NMHSs.
- Collecting and disseminating best practices.
- Providing scientific context and input.
- Organizing education and training activities.
- Organizing forums, meetings and workshops for discussion and exchange.
- Organizing data and/or product exchange.
- Providing advocacy at global, regional and national levels.
- Assisting in resource mobilization.
- Assisting in project development and coordination.
- Implementing demonstration and pilot projects at regional, subregional and national levels.
- Assisting with cross-program capacity development activities and other capacity development work of WMO constituent bodies.
- Developing tools for collecting and sharing information.
- Monitoring capacity development of weather, climate and hydrology services in the NMHSs of Members.

Services Commission

The Commission for Weather, Climate, Water and Related Environmental Services & Applications (Services Commission) contributes to the development and implementation of globally harmonized weather, climate, water, ocean and environment-related services and applications to enable informed decision making and realization of socioeconomic benefits by all user communities and society as a whole.

The Services Commission encompasses application areas with substructures as needed to implement the WMO strategic plan including, but not limited to the following: Regulated and existing meteorological services (covered by WMO Technical Regulations (WMO-No. 49), in accordance with General Terms of Reference 2): aeronautical meteorological services, marine and oceanographic meteorological services, agrometeorological services, public weather services, climatological services, hydrological services. Emerging services under development (currently subject of studies and evaluation for possible inclusion in regulated services, in accordance with General Terms of Reference 1): urban services, environmental services, multi-hazard early warning services, polar and mountain area services, health, energy, water management, land transportation, other, as may become necessary. Potential category for hydrological services.

Infrastructure Commission

The Commission for Observation, Infrastructure and Information Systems (Infrastructure Commission) contributes to the development and implementation of globally coordinated systems for acquiring, processing, transmitting and disseminating Earth system observations, and related standards. It also ensures coordination of the production and use of standardized analysis and model forecast fields and development and implementation of sound data and information management practices for all WMO programs and their associated application and services areas.

The Infrastructure Commission promotes the development of integrated systems to cover all application areas wherever possible. It is responsible for ensuring that these systems

- are user-driven, applicable, accessible and as modular and scalable as possible;
- provide earth system observations, processed data and relevant services products and information to Members
- offer life-cycle management across the full range of WMO Members;
- make full use of existing WMO and other relevant standards and regulations;
- make use of and promote public-private engagement where advantageous;
- incorporate state-of-art optimal and fit-for-purpose technology;
- align with user requirements developed in coordination with Science Advisory Panel and the Research Board on Weather, Climate, Water and the Environment; and
- build upon existing partnerships and networks among communities of practice within the service areas, which are beneficial for WMO Members.

Research Board on Weather, Climate, Water and the Environment.

The Research Board on Weather, Climate, Water and the Environment translates the strategic aims of WMO and decisions of the Executive Council and the World Meteorological Congress into overarching research priorities, and ensures the implementation and coordination of the research programs to achieve these priorities in accordance with the purposes of Organization defined in Article 2(f) of the Convention.

The Board shall coordinate implementation and resourcing of WMO research programs, taking into account the advice of the Executive Council Scientific Advisory Panel (SAP). The Board shall address

Members' needs and support implementation of the WMO Strategic Plan based on science and implementation plans approved by the Executive Council and any co-sponsor governing bodies, as appropriate, for WMO research programs and activities.

Joint WMO-IOC Collaborative Board.

Based on the recommendations of the Joint WMO-IOC Consultation Group on the Reform of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), Congress 18, through Resolution 9 (Cg-18), and the 30th IOC Assembly, through Resolution XXX-2, established the Joint WMO-IOC Collaborative Board.

Resolution 9 (Cg-18) and IOC Resolution XXX-2 established the following goals: (1) to incorporate appropriate JCOMM functions and activities on observation and operational ocean forecasting systems into the IOC-WMO-UN Environment-ISC Global Ocean Observing System (GOOS), with functional connections to the Commission for Observation, Infrastructure and Information Systems; (2) to incorporate appropriate JCOMM functions and activities on data management and processing into the Commission for Observation, Infrastructure and Information Systems, with a close connection to the work of the IOC International Oceanographic Data and Information Exchange; (3) to incorporate appropriate JCOMM functions and activities on services into the Commission for Services and Applications, with a close connection to relevant IOC activities in early warning and services; and (4) to establish the Joint WMO-IOC Collaborative Board as a high-level coordination mechanism with broader engagement of the key relevant bodies of the WMO and IOC, with the terms of reference as given in the Annex to this Resolution. The Resolution further recommends that for its first intersessional period, the current co-chairs of the Joint WMO-IOC Consultation Group on the Reform of JCOMM co-chair the Joint WMO-IOC Collaborative Board, with the technical advice of the current JCOMM co-presidents. It notes that these co-chairs should have flexibility to adjust the length of initial appointment terms defined in the Terms of Reference, in order to stagger future rotation of members. Review of the performance of the Joint WMO-IOC Collaborative Board in coordination with IOC governing bodies is recommended, with an initial review in four years. The proposed Joint WMO-IOC Collaborative Board would facilitate the continued work of all JCOMM functions and activities by recommending connections to appropriate working structures on both sides, make recommendations on evolving the governance for GOOS in consultation with all co-sponsors in order to further develop the partnership and functional connections between GOOS and the WMO Integrated Global Observing System, and encourage WMO Members and IOC Member States to coordinate national responses to the advice of the Joint WMO-IOC Collaborative Board brought to WMO and IOC governing bodies. It would also prepare a comprehensive and coordinated WMO-IOC Collaborative Strategy based on existing sectoral strategies in consultation with WMO and IOC technical, scientific and regional bodies. This strategy would be submitted in two years to the WMO and IOC governing bodies for adoption. The Secretary-General of WMO is to define, in consultation with the IOC Executive Secretary, the working arrangements for the sponsorship of current JCOMM bodies and for the Joint WMO-IOC Collaborative Board and to report on implementation at the 72nd session of the Executive Council. He also has the responsibility to evaluate, in consultation with the IOC Executive Secretary, the financial and secretariat support requirements for the Joint WMO-IOC Collaborative Board and make adequate provisions in the budget. The Resolution also calls on the IOC Assembly to reflect its contents in its decisions.

Science Advisory Panel.

The SAP shall draw up opinions and recommendations to Congress and to the Executive Council on matters concerning WMO research strategies and the optimal scientific directions to support the evolution of its mandate in weather, climate, water and related environmental and social sciences.

SAP draws up opinions and makes recommendations to the WMO Congress and to the Executive Council on matters concerning WMO research strategies and the optimal scientific directions to support the evolution of its mandate in weather, climate, water and related environmental and social sciences. The Panel shall provide forward-looking strategic advice on emerging challenges and opportunities, and in particular: advise on areas in which, on the basis of available evidence, new technological and scientific advancement would lead to new applications related to WMO core activities; promote the global standing and visibility of WMO as a leading scientific organization in the fields of weather, climate, water and related environmental and social sciences within the United Nations and otherwise; enhance the WMO role as facilitator of international cooperation in weather, climate, water, ocean and environmental sciences among all role players; promote the WMO vision and mission, and its downstream trends, with WMO and among its Members, as the primary driver for innovation, understanding and the development of new and improved weather, climate, water, ocean and related environmental services and know-how.

Members

Each WMO Member State and territory has the overall responsibility for the development of its NMHS. While Members may have differing arrangements, NMHSs are normally governmental institutions with an important national role to play in support of a wide range of domestic and international responsibilities. Members must, therefore, define the duties of their NMHSs. Once those duties have been defined and agreed upon at the appropriate legislative or governmental level, the type of service to be provided by the NMHSs and the resources needed to fulfil their responsibilities can be determined. While WMO can provide examples of the basic duties of NMHSs, of the resources required and best practices, allocation of responsibilities and levels of service to be sustained are national decisions.

In addition to maintaining a plan reflecting basic duties and special services, exhibiting good management and building scientific and user relationships, NMHSs need to be involved in national planning. Arrangements for development assistance within the United Nations system, as well as funding from external sources, are largely based on country strategies. Moreover, support from other government departments or agencies for special services in agriculture, energy, health, water, land management, transportation and civil aviation, voiced at the national level, increases the likelihood of sustained development.

Global weather and climate models do require global data. The interdependence of NMHSs around the world becomes more evident as their scope expands to provide responses to policy issues such as climate change. Countries must contribute to international efforts, as the benefits of doing so far outweigh the costs. More developed countries serve as global or regional centers, providing guidance to other countries. Some Members, which actively participate in WMO bodies, assist other Members on a bilateral basis.

For further details on the capacities of NMHSs, see Annex 5: Categorization of National Meteorological and Hydrological Services.

WMO partners

- Other UN Agencies
- National space agencies, including their coordination bodies, the Committee on Earth Observation Satellites and the Coordination Group for Meteorological Satellites
- World Bank

Resource mobilization and financing mechanisms

The World Meteorological Organization receives funding from its Members through assessed contributions to support core budget activities, including the work of the Secretariat, regional associations and technical commissions. In addition to regular budget funding, WMO mobilizes voluntary resources (extra-budgetary) through a range of funding modalities to support specific capacity development activities.

Financing mechanisms available to WMO and its Members.

- **SOFF**
- **Development banks**
 - Financing provided by the World Bank and regional development banks, such as the Asian Development Bank (ADB), the African Development Bank (AfDB), the European Bank for Reconstruction and Development (EBRD) and the Inter-American Development Bank (IDB), is generally negotiated by the banks directly with ministries of foreign affairs and/or finance of the recipient countries. It may include grants, soft loans, loans, etc. Development banks predominantly provide loans with some grant support, generally on a bilateral basis. For this reason WMO should focus on helping NMHSs access and engage in these mechanisms through national level processes.
- **Climate funds**
 - The key climate funds that countries can approach, with WMO assistance, to support the Global Framework for Climate Services (GFCS) are:
 - The Adaptation Fund: This fund was established by the Parties to the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) to finance “concrete” adaptation projects/programs in developing countries (Non-Annex I Parties to the Convention). The WMO became accredited with the Adaptation Fund as a multilateral implementing entity in December 2010 and can, therefore, submit projects, in line with National Adaptation Plans, on behalf of eligible Members.
 - The Green Climate Fund: The seventeenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC COP 17) adopted a governing instrument for the Green Climate Fund and a process for its full operationalization by 2014. The Fund’s long-term goal is to mobilize US\$ 100 billion annually in climate finance by 2020. The Green Climate Fund, which aims to become the main multilateral financing mechanism in support of climate action in developing countries, will be a legally independent institution with its own separate secretariat accountable to the COP. Since the Durban Package did not include any agreement on long-term sources of climate financing, the biggest challenge for the Green Climate Fund will be to secure adequate and sustained funding.
 - The Global Environment Facility: The Global Environment Facility and two other funds administered by it, the Least Developed Countries Fund and the Special Climate Change Fund, focus on climate change mitigation and adaptation activities. They support projects related to agriculture and food security, health, water resources, and disaster prevention.
 - The Climate Investment Funds: Two funds that provide developing countries with the resources needed to reduce their greenhouse gas emissions and mitigate the impacts of climate change. The Clean Technology Fund and the Strategic Climate Fund channel their financial support through the AfDB, ADB, EBRD, IDB and the World Bank Group. There are three programs under the Strategic

Climate Fund: the Pilot Program for Climate Resilience, the Forest Investment Program and the Program for Scaling up Renewable Energy in Low Income Countries.

- Additional climate funds (list available at <http://www.climatefundupdate.org/listing>) focusing on clean development mechanisms and reduction of carbon emissions may offer peripheral opportunities.

- **The United Nations system**

- The initiatives of United Nations agencies involved in direct country assistance and financing, such as the Food and Agriculture Organization of the United Nations, the International Fund for Agricultural Development, the United Nations Development Programme, the United Nations Environment Programme, the World Food Programme, the United Nations Educational, Scientific and Cultural Organization and the World Health Organization, can support the modernization of NMHSs. These United Nations entities should be part of the GFCS governance mechanisms and should be encouraged to incorporate GFCS into their development initiatives. This would help provide resources for GFCS implementation through direct financing and leveraging of related activities.

- **Official Development Assistance**

- There has been an increasing focus on water, the environment, health and, more recently, climate change in the Official Development Assistance (ODA) sector, as indicated by the 2011 report of the Development Assistance Committee of the Organisation for Economic Co-operation and Development (OECD). The WMO must draw the attention of the ODA sector to the role that weather and climate can play in stalling or slowing down economic development and poverty alleviation and hence to the need for climate-resilient development. Encouraging NMHSs in LDC and SIDS to engage with their ministries of foreign affairs and related ODA programs will be crucial for channeling funds towards the capacity development of National Meteorological or Hydrometeorological Services and NMHSs in those countries.

- **Regional institutions**

- Regional institutions such as regional intergovernmental bodies and regional economic groupings exist in all WMO Regions. The regional economic communities in Africa, for example, group individual countries in subregions in order to achieve greater economic integration. They are described as the building blocks of the African Union and are central to the strategy for implementing the New Partnership for Africa's Development.
- The WMO has a subregional office located in the headquarters of the Secretariat of the Pacific Regional Environment Programme. Establishing strong partnerships with relevant regional organizations provides a major opportunity to leverage support for the development of weather and climate services.

- **Private sector**

- While governments are responsible for driving climate change solutions that address the needs of the poorest and most vulnerable, the private sector is an essential partner in preparing for and responding to the impacts of climate change and in building a global green economy.

ANNEX 1: Glossary

Capacity: Capacity is the ability of a human system to perform, sustain itself and self-renew (Ubels et al., 2010).

Capacity building: The process of building capacities is based on the assumption that there are no capacities to start from. This approach can be relevant to crisis or immediate post-conflict situations but is considered to be less comprehensive than capacity development.

Capacity development: The process of strengthening the abilities or capacities of individuals, organizations and societies to sustainably solve their problems and meet their strategic objectives.

National Meteorological and Hydrological Services (NMHS). National Meteorological and Hydrological Services can be classified into four categories (i.e., Basic, Essential, Full, and Advanced), according to the level of service they are able to provide and the resources required for ensuring these services. The purpose of this classification system is to help countries better understand the capabilities required to provide weather, climate, ocean and hydrology services, and identify what is needed in their own NMHS to ensure the desired service level.

Earth Systems Monitoring Approach:

Numerical Weather Prediction (NWP): The practice of predicting the future state of the atmosphere from the present state, using computer-encoded versions of the predictive equations of atmospheric behavior. The present state is calculated from a comprehensive set of observational data from the entire global domain. The term refers to predicting the “weather” because this tool was originally used for medium range prediction. The technique has since been widely adopted for monitoring and understanding how climate has changed in the past and how it may be evolving in the future.

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