

COUNTRY HYDROMET DIAGNOSTICS

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



Draft prototype for road-testing

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EXECUTIVE SUMMARY

Global threats and challenges related to climate change and the impact of extreme weather events are rising, and demand to provide high-quality weather, climate, hydrological, and related environmental information services - referred to as HYDROMET - is rapidly increasing. Despite the urgency and substantial investments in strengthening developing country hydromet capacity, difficulties remain in monitoring and tracking performance of public meteorological services in an easy understandable and coherent manner.

The Country Hydromet Diagnostics responds to the need for a standardized, integrated and operational tool and approach for diagnosing National Meteorological Services, their operating environment, and their contribution to high-quality weather, climate, hydrological and environmental information services and warnings. The Diagnostics is an umbrella tool that draws on and adds value to existing WMO assessment material by synthesizing existing approaches and data into an easily interpretable form, validating the information provided by WMO Members through a peer review process, and obtaining missing information.

The Diagnostics aims at informing policy and investment decision-making, in particular guiding investments of the members of the Alliance for Hydromet Development. The Alliance brings together major development and climate finance partners behind a joint commitment to strengthen developing country hydromet capacity. Through the Diagnostics, developing countries are expected to benefit from better targeted and aligned support.

The Country Hydromet Diagnostics is based on the ten most critical elements the hydromet value cycle, grouped under four categories – enablers, observation and data processing system, service and product production and dissemination, and user and stakeholder interaction. For each value cycle element, a limited number of standardized indicators is used, and each indicator uses explicitly defined data sources. The Diagnostics draws as much as possible on primary data (self-reported and other sources of quantitative data), but to inform the peer review requires additional data, in particular data from country user/client surveys. The WMO Community Platform provides the primary source of data information requirements for the Diagnostics and the results of the Diagnostics will be integrated in the Platform adding substantial value.

The definition of the maturity level for each of the ten critical elements will indicate where additional focus and support is needed. The maturity levels draw as much as possible on existing categorizations including the service delivery progress model outlined in the WMO Service Delivery Strategy, the WMO Capacity Development Strategy and the Climate Services Checklist.

The Diagnostics uses peer review as its overarching approach, following examples of other organizations, including the OCED process for the peer review of member's development assistance. As peers, advanced National Meteorological and Hydrological Services from developed and developing countries will undertake the Diagnostics, strictly following the tool. This will enable coherent and

standardized Diagnostics across countries. The Diagnostics is expected to be undertaken by the WMO Country Support Initiative.

The Diagnostics is tailored for application in developing countries as it is supposed to demonstrate measurable progress in closing the hydromet capacity gap. The participation of countries as well as dissemination of the results of the Diagnostics are voluntary and require the consent of the WMO Permanent Representative. The peer review will be undertaken in dialogue and collaboration with the WMO Permanent Representative, respective country stakeholders, and the members of the Alliance for Hydromet Development, with self-assessed data as the starting point.

The Diagnostics is developed through a phased and learning approach. In the first phase, the draft “prototype” has been developed and will be road -tested with selected countries. The road-testing will further engage countries, peer reviewers and Alliance members in the refining the Diagnostics and capturing lessons learned. Based on the road-testing experience and in collaboration with the WMO Presidents of Regional Associations, the two Technical Commissions, the Research Board, and the members of the Alliance for Hydromet Development, the prototype of the Diagnostics is expected to be refined by March 2021. In the second phase, applying the refined tool, the Diagnostics will be undertaken with all interested developing countries.

The Diagnostics and the initial results of the road-tests will be presented in the first Alliance Hydromet Gap Report, expected to be launched in June 2021 at the occasion of World Meteorological Congress. The Diagnostics is expected to provide the analytical foundation for the regular Alliance Hydromet Gap Reports, as the means of tracking the progress on closing the capacity gap and corresponding Alliance commitments.

Table of Contents

| | |
|--|----|
| 1. Context | 5 |
| 2. Development | 6 |
| 3. Considerations | 7 |
| 4. Components | 8 |
| 5. Critical Elements | 11 |
| 6. Country Hydromet Diagnostics tool | 13 |

List of Figures

| | |
|---|----|
| Figure 1. The Hydromet Value Cycle..... | 8 |
| Figure 2. Components of the Country Hydromet Diagnostics..... | 9 |
| Figure 3. Example of visual high-level presentation of Diagnostics results..... | 10 |

1. Context

Global threats and challenges related to climate change and the impact of extreme weather and related environmental events are rapidly increasing. The World Economic Forum has over the past number of years consistently identified extreme weather and natural hazards related to climate, water, and the environment as the top risks globally.

The impacts of the COVID-19 crisis have further exacerbated vulnerabilities. It has also demonstrated the vulnerability of the global observing system and the urgent need to strengthen the reliability of the system. Billions of dollars are expected to be spent in recovery and response packages that more than ever need to be anchored on climate resilience and sustainability standards more than ever.

With this context, demands to provide high-quality weather, climate, hydrological, and related environmental information services – referred to as HYDROMET – are exponentially increasing. Governments, communities, and productive sectors require information to make wise choices in the context of rapidly changing technology, new players, growing populations, urbanization, and pressure on natural resources. While demand is exponentially growing, many National Meteorological Services (NMSs)ⁱⁱ in developing countries are facing major performance challenges. Despite the urgency and investments in strengthening NMSs capacity, especially in developing countries, difficulties remain in monitoring and tracking their performance and contributions in an understandable and coherent manner.

Assessing hydromet capacity and performance including benchmarking of National Meteorological and Hydrological Services in developing countries is one of the priorities of the Alliance for Hydromet Development for 2020.ⁱⁱⁱ The Alliance was launched at the twenty fifth Conference of Parties (COP 25) of the United Nations Framework Convention on Climate Change in Madrid^{iv} and brings together major climate and development finance partners with the goal of closing the hydromet capacity gap by 2030. The Country Hydromet Diagnostics aims to inform Alliance members' policy and investment decisions and to provide an analytical foundation for the Hydromet Gap Report, as the means of tracking progress on the Alliance commitments.

The Country Hydromet Diagnostics responds to the need for a standardized and practical analytical foundation for targeted and coherent hydromet investments. The need for the development of a Diagnostics tool for NMSs emerged as part of the operationalization of the Country Support Initiative (CSI) that was approved by the 18th World Meteorological Congress in June 2019.^v Later, at a CSI workshop hosted by the Austrian Central Institute of Meteorology and Geodynamics in Vienna, 2019, it was agreed to prioritize the development of the tool. It also contributes to the implementation of Congress Resolution 6^{vi} that calls for the establishment of an effective performance monitoring and evaluation process of WMO Members.

2. Development

The development of the tool is guided by a **Working Group and undertaken in collaboration with the Alliance for Hydromet Development**. The WMO Secretariat contracted a consultant in February 2020 to support the development of the tool that *“supports senior-level decision making, including of development and climate finance partners, on investments and resource allocation”^{vii}* A multi-partner Working Group to guide the work of the consultant was established in March 2020, including representatives from Alliance members, CSI advisory partners, and WMO Secretariat.

A tool developed with technical guidance from WMO Technical Commissions, Research Board, and Presidents of Regional Associations. As the Diagnostics builds on existing work and aims at creating an “umbrella” tool, it is recommended that its final development and future refinement be guided by the two Technical Commissions and the Research Board in coordination with the WMO Presidents of Regional Associations. Development of the Diagnostics could become a “test case” for the collaborative and effective functioning of the new WMO Constitution Bodies, in line with the WMO reform objectives and Resolution 74 that requests the Technical Commissions to provide technical guidance to the CSI on translating WMO standards into operational advice tailored to the needs of developing Member countries.

A tool developed in phases.

- **In the first phase (2020-2021)**, the “prototype” version of the tool is being developed and road-tested in selected countries, supported by Alliance members. Based on the road-testing experience and in collaboration with the WMO Presidents of Regional Associations, the two Technical Commissions, and the Research Board, the prototype of the Diagnostics is expected to be further refined by March 2021. The tool and the initial results of the road-tests will be presented in the first Alliance Hydromet Gap Report, expected to be launched in June 2021 at the occasion of the World Meteorological Congress.
- **In the second phase (2021-2022)**, having a further refined^{viii} tool, the Diagnostics will be undertaken with all interested developing countries. The results will be communicated in the second Alliance Hydromet Gap Report.
- **In the third phase (2022 onwards)**, the tool will be systematically refined and adapted, based on the lessons learned from the previous phases. The Alliance Hydromet Gap Reports will communicate the results of the regular Diagnostics, as a means of tracking progress in closing the hydromet capacity gap.

3. Considerations

A standardized, practical, and integrative “umbrella” tool. The tool will enable a coherent and standardized diagnostic across countries. It is an operational and practical tool, and therefore needs to be selective and focus on the most important aspects of the hydrometeorological value cycle - see tool components in section 4. It builds on a large body of assessment and quality assurance guidance material developed through WMO inter-governmental processes, including in particular the WMO Service Delivery Strategy and the WMO Capacity Development Strategy^{ix} as well as the experience and practices of development and climate finance partners. As an “umbrella” tool it has a modular approach, i.e. as applicable, elements of the Diagnostics can be complemented with existing tools and methodologies.

A tool that adds value to existing WMO assessment material in three ways (i) synthesizing existing approaches and data into an easily interpretable form, (ii) substantiating the information provided by WMO Members through a peer review process, (iii) filling data and information gaps working in collaboration with countries and their development partners.

A tool that creates a common understanding on how to assess the performance of public National Meteorological Services, their operating environment, and their contribution to high-quality weather, climate, hydrological and environmental information services and warnings. While the elements of the tool are applicable to all countries, the tool is tailored for application in developing countries as it is supposed to serve as the means to demonstrate measurable progress in closing the hydromet capacity gap.

A tool that serves WMO developing country Members by guiding hydromet investment decisions. The Diagnostics undertaken with this tool are expected to inform senior policy and investment decision-making, in particular investment decisions from Alliance members. WMO developing country Members are expected to benefit from targeted and aligned support from the Alliance members as it considers the full value cycle and the institutional setting and uses the concept of maturity level— see section 4 – as a benchmark to guide resource allocation where more support and focus is needed.

A tool in support of the Alliance for Hydromet Development. The tool responds to the agreed priority action of the Alliance and is developed in close collaboration with its members, ensuring that their information needs are properly addressed. The development of the tool is spearheaded and technically supported by WMO in its role as the facilitator and technical advisor of the Alliance. The results of the Diagnostics will be disseminated through the Alliance regular Hydromet Gap Report.

A tool applied with a peer review approach. The Diagnostics is expected to be undertaken by the WMO Country Support Initiative on behalf of the Alliance. As peers, advanced National Meteorological and Hydrological Services (NMHSs) from developed and developing countries (CSI advisory partners) will undertake the regular Diagnostics, strictly applying the tool. The Diagnostics are expected to be co-

funded by different sources, including by Alliance members and donors contributing to the planned CSI multi-donor trust fund.

A voluntary diagnostic. All developing countries^x are eligible for the diagnostic. The participation of countries as well as dissemination of the Diagnostics results are voluntary and will require the consent of the WMO Permanent Representative. The Diagnostics will be undertaken in dialogue and collaboration with the WMO Permanent Representative and respective country stakeholders, with self-assessed data as the starting point.

4. Components

A tool based on the hydromet value cycle. The value cycle in a typical NMS follows an approach as depicted in Figure 1. In this cycle, services to society that build resilience against hazards and related risks take center stage. Countries face different hydromet challenges, and each country has a unique institutional setting. While these differences are important, the critical elements summarized in the value cycle in Figure 1 are relevant to all countries.

Critical elements of the hydrometeorological value cycle

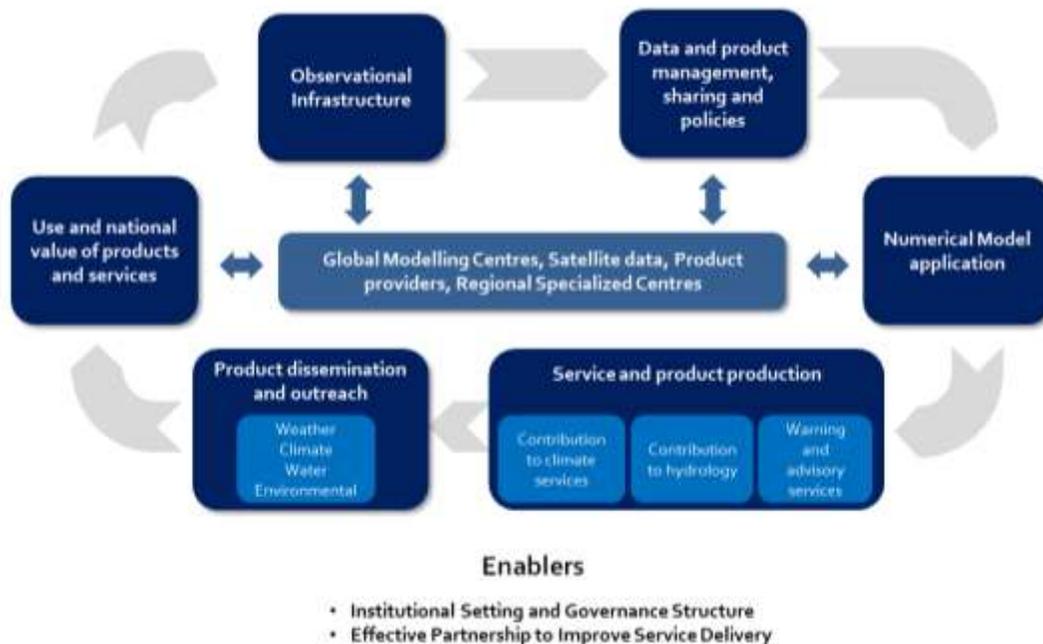


Figure 1. The Hydromet Value Cycle. Section 5 describes the elements in more detail.

For each critical element of the value cycle, the Country Hydromet Diagnostics specifies indicators and data sources that are the basis for the definition of maturity levels. In other words, the Diagnostics is composed of four components: 10 critical elements of the hydromet value cycle, standardized indicators for each critical element, maturity levels for each element, and data sources to be used as the basis for the review review (see Figure 2).

| Country Hydromet Diagnostics | | | |
|--|---|--|--|
| Components | | | |
| | Indicators | Maturity level | Data sources |
| 10 critical elements of the hydromet value cycle | Standardized indicators for each critical element | Informing where additional focus and support is needed | Peer assessment based on a data sources tiered-approach: Self-assessed Objective data Client survey-based |

Figure 2. Components of the Country Hydromet Diagnostics.

- **Indicators.** For each element, a limited number of standardized indicators is used.
- **Maturity levels.** Maturity models are widely used across a range of disciplines as a means of assessing organizational effectiveness. Typically, the model would have five levels, each one defined with reference to a range of characteristics, metrics, or indicators. For the purpose of the Country Hydromet Diagnostics, the maturity levels will indicate where additional focus and support is needed. The maturity levels draw as much as possible on existing categorizations including the service delivery progress model outlined in the WMO Service Delivery Strategy, WMO Capacity Development Strategy and the Climate Services Checklist. An example of the visual representation of the Diagnostics results is provided below.

Country Hydromet Diagnostics 2021

| Maturity levels | | Value Cycle Elements | | | | | | | | | | |
|-----------------|----------------------|--------------------------------------|--|--|---------------------------------------|--|--|----------------------------------|---------------------------|------------------------------------|---|---|
| | | Enablers | | Observation and Data Processing System | | | Service and Product Production and Dissemination | | | User & Stakeholder Interaction | | |
| | | Governance and institutional setting | Effective partnerships to improve service delivery | Observational infrastructure | Data and product sharing and policies | Numerical model and forecasting tool application | Warning and advisory services | Contribution to climate services | Contribution to hydrology | Product dissemination and outreach | Use and national value of products and services | |
| 1 | Highest capacity gap | | | | | | | | | | | |
| 2 | ↑ | Country A | 1 | 2 | 3 | 4 | 5 | 4 | 2 | 1 | 4 | 4 |
| 3 | | Country B | 3 | 3 | 5 | 1 | 4 | 4 | 3 | 3 | 1 | 1 |
| 4 | | Country X | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 |
| 5 | | Country Y | 2 | 1 | 4 | 1 | 4 | 4 | 3 | 3 | 4 | 3 |

Figure 3. Example of visual high-level presentation of Diagnostics results. For each element maturity levels will be assessed, based on the indicators and applying the tiered data approach.

- **Data sources.** The Country Hydromet Diagnostics uses peer review as its overarching approach drawing on different data sources and types. For each indicator, explicitly defined data sources are drawn upon and a tiered approach is being applied. Data types used for the peer review are: self-assessment data; objective and quantitative data; and for some of the indicators, client-surveys are expected to be undertaken across all participating countries.
 - **WMO Members information in the WMO Community Platform** provides the primary source of information on which the Diagnostics is based. The Diagnostics draws as much as possible on primary data (self-reported and quantitative data), but to inform the peer review additional data will be required, in particular data from country user/client surveys. The results of the Diagnostics would be included in the WMO Community Platform and hence add substantial value to the platform, filling the information gaps and producing information tailored to the needs of the members of the Alliance for Hydromet Development.
 - **The Climate Services Checklist** assesses in a comprehensive manner the climate service provision capacity within a country in five categories namely less than basic, basic, essential, full, and advanced climate services provision capacity. The results of the checklist are used as input to element seven of the Diagnostics (*contribution to climate services*).
 - **The WMO Survey on Hydrological Capabilities** which has three components, namely: general questionnaire; INFOHYDRO questionnaire (related to hydrological data collection and management); and questionnaire on hydrological forecasting is being used to inform element 8 of the Diagnostics (*contribution to hydrology*).
 - **Other sources of information.** There are various sources of information available, including from the monitoring done by the World Modelling Centers and others. Some of this information,

especially those related to data flows are objective and automatically tracked. Development partners also have data that are expected to be considered. Independent country client surveys on a limited number of indicators will provide additional and highly important data to inform the peer review.

- **Peer review process.** NMHS CSI advisory partners will undertake peer reviews in dialogue with the countries, drawing on self-assessed, quantitative, and client survey data. This approach follows peer review processes applied by other organizations including the OECD process for the peer review of member's development assistance. These OECD/DAC peer reviews provide in-depth examinations of development systems and policies in all member countries. For more than 50 years this OECD/DAC peer reviews provide critical, respectful and helpful support – helping members make their development programmes more effective.

5. Critical Elements

Ten critical elements of the hydromet value cycle have been defined to diagnose the extent to which the full value cycle is being addressed, under four categories.

A. ENABLERS

1. **Governance and institutional setting.** The formalization of the NMS mandate and its implementation, oversight, and resourcing.
2. **Effective partnership to improve service delivery.** Effectiveness of the NMS in bringing together national and international partners therefore improving the service offering. This includes the academic, research, private sector and climate and development finance institutions.

B. OBSERVATION AND DATA PROCESSING SYSTEM

3. **Observational infrastructure.** The level of compliance of the observational infrastructure and its data quality with prescribed standards.
4. **Data and product management, sharing, and policies.** The nature of data and product sharing on a national, regional, and global level.
5. **Numerical model and forecasting tool application.** The role of numerical model output and forecasting aids such as remotely sensed products in product generation; whether models are run internally and if the value-added compared to global models is determined.

C. SERVICE AND PRODUCT PRODUCTION AND DISSEMINATION

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

7. **Contribution to climate services.** NMS role in and /or contribution to a national climate framework according to the established climate services provision capacity.
8. **Contribution to hydrology.** NMS role in and contribution to hydrological services according to mandate and country requirements.
9. **Product dissemination and outreach.** Effectiveness of the NMS in reaching all public and private sector users and stakeholders.

D. USER AND STAKEHOLDER INTERACTION

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

6. Country Hydromet Diagnostics tool

| Critical Hydromet Value Cycle Element | | Maturity level | Indicators | Data sources (to be further developed) | Data type ^{xi} |
|--|---|--|---|---|-------------------------|
| Element | Description | | | | |
| ENABLERS | | | | | |
| 1. GOVERNANCE AND INSTITUTIONAL SETTING | Formalization of the NMS mandate and its implementation, oversight, and resourcing. | <p>Level one: Weakly defined mandate; serious funding challenges; essential skills lacking; little formalized governance and future planning</p> | 1.1. Act or Policy describing the NMHS legal mandate and its scope | 1.1 WMO Community Platform: (i) Legislative act regulating meteorology (none, law, decree, other); (ii) Title of primary legislative act determining NMS functions; (iii) NMS areas of responsibilities. | Objective |
| | | <p>Level two: Effort ongoing to formalize mandate, introduce improved governance and management processes and address resources challenges</p> | 1.2. Existence of Strategic, Operational and Risk Management plans and their reporting as part of oversight and management | 1.2 WMO Community Platform: (i) Development/ strategic plan in place in NMS; (ii) Main priority areas. To be included: (iii) National Strategic Plan timeline and status (pending approval, exists but update needed, etc.). | Objective |
| | | <p>Level three: Moderately well mandated, managed and resourced and clear plans for, and sufficient capacity to address operational gaps</p> | 1.3. Government budget allocation consistently covers the needs of the NMS in terms of its national, regional, and global responsibilities and based among others, on cost-benefit analysis of Service. | 1.3 No consistent data currently available. WMO Community Platform: Studies on the social and economic benefits of weather, climate, and water services were undertaken in the last 10 years (Yes/No). | No data available |
| | | <p>Level four: An effective service but with a few shortcomings related to its mandate, governance, and resourcing and in the process to address the gaps</p> | 1.4. Proportion of staff (availability of in-house, seconded, contracted-out) with adequate training in relevant scientific, technical, and ICT disciplines. | 1.4 Data available from the WMO survey on the Status of Human resources of NMHSs (WMO Education and Training Programme). | Self-assessed |
| | | <p>Level five: Strong and comprehensive mandate, highly effective governance, secure funding, and readily available skills base.</p> | 1.5. Experience and track-record in the implementation of internationally funded hydromet projects and research and development projects in general. | 1.5 Dependent on maturity level – level 1 and 2 additional international resources to be focused first on institutional and governance issues; level 3 and 4 on operational issues and level 5 perhaps for functions to assist neighboring countries. | No data available |

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| 2. EFFECTIVE PARTNERSHIPS TO IMPROVE SERVICE DELIVERY | Effectiveness of the NMS in bringing together national and international partners therefore improving the service offering. | <p>Level one: Works in isolation and does not value or promote partnerships</p> | 2.1. Effective partnerships in place with other government institutions | 2.1 No data currently available | No data available |
| | | <p>Level two: Limited partnerships and mostly excluded from climate finance opportunities</p> | 2.2. Effective partnerships in place at national and international level with private sector, research centres and academia, including joint research and innovation projects | 2.2 WMO Community Platform: (i) legislation on private sector providing information and services along the value chain (ii) Formal agreements between public and private sector in relation to service delivery, operation, and maintenance of networks, observation data; (iii) consultative platform for the public sector, private sector, academia, and civil society to foster regular cooperative dialogue | Objective |
| | | <p>Level three: Moderate effective partnerships but generally regarded as the weaker partner in such relationships, having little say in climate financing initiatives</p> | | | |
| | | <p>Level four: Effective partnership with equal status in most relationships and approaching climate funding opportunities in a coordinated manner</p> | 2.3. Effective partnerships in place with international climate and development finance partners | 2.3 No data currently available | No data available |
| | | <p>Level five: NMS is regarded as a major national and regional role player, has extensive and productive partnerships and viewed as an honest broker in bringing parties together and provide national leadership on climate finance decisions</p> | 2.4. New or enhanced products, services or dissemination techniques or new uses or applications of existing products or services that culminated from these relationships | 2.4 No data currently available | No data available |
| OBSERVATION AND DATA PROCESSING SYSTEM | | | | | |
| 3. OBSERVATIONAL INFRASTRUCTURE | The level of compliance of the observational infrastructure and its data quality with prescribed standards. | <p>Level one: No or limited, basic surface observations and no upper-air observations</p> | 3.1. Average horizontal resolution in km of both synoptic surface and upper-air observations | 3.1 OSCAR database as per the Rolling Review of Requirements (RRR) as per the 14 application | Objective |
| | | <p>Level two: Basic network, large gaps, mostly manual observations with serious challenges and/or data quality issues</p> | 3.2. Additional observations used for nowcasting and specialized purposes | 3.2 OSCAR database | Objective |
| | | <p>Level three: Moderate network with some gaps w.r.t. WMO regulations and guidance and with some data quality issues</p> | 3.3. SOPs in place for the deployment, maintenance, calibrations and quality assurance of the observational network | | No data available |
| | | <p>Level four: Comprehensive mostly automated network providing good</p> | | | |

| | | | | | |
|--|--|---|---|---|---------------|
| | | <p>traceable quality data fully compliant with WMO regulations and guidance</p> <p>Level five: Comprehensive and highly automated advanced network including additional measurements and remote sensing platforms providing excellent data fully compliant with WMO regulations and guidance</p> | 3.4. Percentage of the surface observations that depend on automatic techniques | OSCAR database | Objective |
| 4. DATA AND PRODUCT SHARING AND POLICIES | The nature of data and product sharing on a national, regional and global level. | <p>Level one: No observational data is shared internationally, and otherwise data is either not available to be shared or any existing data sharing policies or practices or infrastructure effectively does not allow data sharing.</p> <p>Level two: A minority of the required GBON compliant data is shared internationally and any existing data sharing policies or practices or infrastructure severely hampers the manner in which two-way data sharing is happening</p> <p>Level three: GBON compliance with regards to either surface or upper-air data and a data policy and practices and infrastructure in place that promotes the freely and open use of data for research and academic purposes as well as the in-house use of external data</p> <p>Level four: Exceeding GBON compliance with a data policy and practices and infrastructure that support free and open sharing of data within a national context and some products regionally or internationally as well as the in-house use of external data</p> <p>Level five: Exceeding GBON compliance and contributes additional data (marine,</p> | 4.1. Percentage GBON compliance - for how many prescribed surface and upper-air stations are observations exchanged internationally. Usage of regional centers WIGOS centers. | 4.1 Proposed GBON regulations ^{xii} and WIGOS Data Quality Monitoring System which provide real-time statistics on data exchange at an hourly resolution | Objective |
| | | | 4.2. A formal policy and practice for the freely and open sharing of observational data | 4.2 Data Policy Survey contains information on cost recovery policies; Res 60 Survey: data available on provision of climate data and products on a commercial basis; type of users; basis for the price established; who retains the revenue; approx. net annual revenue. Note that this info is currently been collected on a one-time basis. Key aspects could be included in WMO Community Platform core dataset if deemed essential. | Self-assessed |
| | | | 4.3. Main data and products received from external sources in a national, regional and global context, such as model and satellite data | 4.3 Data Policy Survey | Self-assessed |

| | | | | |
|---|---|--|--|---|
| | | radar, etc.) to regional and international initiatives with policies that support promoting and practicing freely and open two-way sharing of data and products on a national, regional and international basis. | | |
| 5. NUMERICAL MODEL AND FORECASTING TOOL APPLICATION | The role of numerical model output and forecasting aids such as remote sensed products in product generation; whether models are run internally and if the value-added compared to global models is determined. | Level one: Forecasts are based on classical forecasting techniques without model guidance and only cover a limited forecast time range | 5.1. Model and remote sensed products form the primary source for products across the different forecasting timescales | <p>Not directly relevant but the following is measured by WMO M&E System and could be considered:</p> <ul style="list-style-type: none"> - # of Members accessing forecast - products developed by GDPFS designated centres (Source: Annual reports from Focal Points of the GDPFS designated centres (World Meteorological Centres and Regional Climate Centres) - # of monthly verification reports provided by Global Producing Centres (GPCs) to the Lead Centres (Source: monthly reports on GDPFS designated centres websites and verified) - # of Members routinely producing decadal forecasts <p>Could potentially be included in WMO Community Platform core data for future data collection.</p> |
| | | Level two: Basic use of external model output and remote sensed products in the form of maps and figures, covering only a limited forecast time range | 5.2. Models run internally, and if so, is data assimilation and verification done and what horizontal resolution applied | |
| | | Level three: Prediction based mostly on model guidance from external and limited internal sources (without data assimilation) and remoted sensed products in the form of maps, figures and digital data and cover nowcasting, short and medium forecast time ranges | 5.3. Probabilistic forecasts produced and if these based on ensemble predictions | |
| | | Level four: Digitized model output from internal (with data assimilation) and/or external (regional) sources and remote sensed products and data used and value added through post processing techniques extended into the extended range | | |
| | | Level five: Optimal combination of global, regional and local models, remote sensed data, post-processing techniques and automated probabilistic product generation over weather and climate time scales with minimal human intervention supported by up to date verification statistics. | | |



No data available

SERVICE AND PRODUCT PRODUCTION AND DISSEMINATION

| | | | | | |
|---|--|--|---|--|---|
| 6. WARNING AND ADVISORY SERVICES | NMS role as the authoritative voice for weather-related warnings and its operational relationship with disaster and water management structures. | <p>Level one: Warning service not operational for public and civil resilience.</p> <p>Level two: Basic warning service is in place and operational but with limited public reach and lacking integration with other relevant institutions.</p> <p>Level three: Weather-related warnings service with modest public reach and informal engagement with relevant institutions, including disaster management structures.</p> <p>Level four: Weather-related warnings service with strong public reach has standard operational procedures driving close partnership with relevant institutions, including disaster management structures.</p> <p>Level five: Comprehensive, impact-based warning service taking hazard, exposure and vulnerability information into account with strong public reach operates in close partnership with relevant national institutions, including disaster management structures and registered CAP alerting authorities.</p> | <p>6.1. Warning and alert service cover 24/7</p> <p>6.2. Hydrometeorological hazards, for which forecasting and warning capacity is available and whether feedback and lessons learned are included to improve warnings</p> | <p>6.1 No data currently available – could be included in WMO Community Platform core dataset for future collection.</p> <p>6.2 No data currently available. To be potentially included in WMO Community Platform core dataset and Sendai Framework monitor.</p> | <p>No data available</p> <p>No data available</p> |
| | | <p>Not Applicable: Climate Services provided by another party</p> <p>Level one: Less than basic Climate Service Capacity</p> <p>Level two: Basic Climate Service Provision Capacity</p> <p>Level three: Essential Climate Service Provision Capacity</p> | <p>6.3. Common alerting procedures in place based on impact-based services and scenarios taking hazard, exposure and vulnerability information into account and with registered alerting authorities</p> | <p>6.3 No data currently available. To be potentially included in WMO Community Platform core dataset.</p> | <p>No data available</p> |
| | | <p>NMS role in and /or contribution to a national climate framework according to the established climate services provision capacity.</p> | <p>7.1. Where relevant, contribution to climate services according to the established climate services provision capacity</p> | <p>Drawing on the Climate Services Checklist</p> | <p>Self-assessed</p> |

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| | | <p>Level four: Full Climate Service Provision Capacity</p> <p>Level five: Advanced Climate Service Provision Capacity</p> | | |
| <p>8. CONTRIBUTION TO HYDROLOGY</p> | <p>NMS role in and contribution to hydrological services according to mandate and country requirements.</p> | <p>Level one: No or very little meteorological input in hydrology and water resource management</p> | <p>8.1. Where relevant, standard products such as QPE and QPF produced on a routine basis according to the requirements of the hydrological community</p> | <p>Detailed data on hydrology is currently being collected through a survey. Needs to include client survey data.</p> |
| | | <p>Level two: Meteorological input in hydrology and water resource management happen on an ad hoc basis and or during times of disaster</p> | <p>8.2. SOPs in place to formalize the relation between Met Service and Hydrology Agency</p> | |
| | | <p>Level three: There is a moderately well-functioning relationship between the meteorological, hydrological and water resources communities but considerable room for formalizing the relationship and SOPs</p> | <p>8.3. Joint projects/initiatives with hydrological community</p> | |
| | | <p>Level four: The meteorological, hydrological and water resources sector have strong SOPs and agreements in place work closely together in developing new and improved products and providing seamless and advanced services</p> | | |
| | | <p>Level five: The meteorological, hydrological and water resources sector have strong SOPs and agreements in place work closely together in developing new and improved products and providing seamless and advanced services</p> | | |

Self-assessed

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| <p>9. PRODUCT DISSEMINATION AND OUTREACH</p> | <p>The effectiveness of the NMS in reaching all public and private sector users and stakeholders.</p> | <p>Level one: Dissemination using only limited traditional channels such as daily newspapers and the national broadcaster and with little control over messaging and/or format.</p> | <p>9.1 Channels use for communication and does the NMS operate its own TV studio</p> | <p>9.1 WMO Community Platform: communication channels used to disseminate products and services (TV, radio, printed media, web app, social media, mobile phone app, other) – to add sms, email.</p> | Objective |
| | | <p>Level two: Traditional communication channels and a basic dedicated website is used to disseminate forecasts and basic information</p> <p>Level three: A moderately effective communication and dissemination strategy and practices in place based only on in-house capabilities and supported by user friendly website</p> | <p>9.2 Education and awareness initiatives in place</p> | <p>9.2 No data currently available</p> | No data available |
| | | <p>Level four: A large fraction of population is reached using a range of communication techniques and platforms, some with partners, and a user-friendly and informative website and apps. Outreach and education activities occur on a regular basis.</p> <p>Level five: A high advanced education, awareness and communication strategy, practices and platforms in place using a wide range of technologies tailored to reach even marginalized communities and with close cooperation with a number of partners.</p> | <p>9.3 Special measures in place to reach marginalized communities, the youth and the elderly</p> | <p>9.3 No data currently available</p> | No data available |

USER AND STAKEHOLDER INTERACTION

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| <p>10. USE AND NATIONAL VALUE OF PRODUCTS AND SERVICES</p> | <p>Accommodation of public and private sector users and stakeholders in the service offering and its continuous improvement.</p> | <p>Level one: Service development lacks any routine stakeholder feedback practice</p> | <p>10.1 Formalized platform to engage with users in order to co-design improved services</p> | <p>10.1 WMO Community Platform: only in relation to climate products</p> | <p>No data available</p> |
| | | <p>Level two: Service development draws on informal stakeholder input and feedback</p> <p>Level three: Services development draws on regular dialogue with major stakeholders</p> <p>Level four: Service development draws on survey data and regular dialogue based on formal relationships with major stakeholders to ensure continuous improvement</p> <p>Level five: Strong partnerships and formal and objective survey and review processes exist with all major stakeholders enabling service co-design and continuous improvement</p> | <p>10.2 Independent user satisfaction surveys conducted and the results</p> | <p>10.2 No data currently available – needs client survey data</p> | <p>No data available</p> |

Endnotes

ⁱ Potential complementary diagnostics for National Hydrological Services might be considered based on lessons learned from road-testing.

ⁱⁱ Official acronym adopted at EC-LII. "11.2.32 The Council also agreed that the relevant national institutions should have the following designations: (a) NMS(s) – National Meteorological or Hydrometeorological Service(s); (b) NMHSs – National Meteorological and Hydrological Services; (c) NHS(s) – National Hydrological Service(s)."

ⁱⁱⁱ Alliance principles and 2020 actions, 4 March 2020

^{iv} Alliance For Hydromet Development Declaration: *Uniting our efforts to close the capacity gap on high-quality weather forecasts, early warning systems, and climate information as the foundation for resilient and sustainable development.* Madrid, 10 December 2019

^v One of the CSI outputs approved by CG-18 Res 74 is the assessment of NMHS performance and compliance related to WMO standards for observational data acquisition, data exchange and service delivery: "Assessments of NMHS performance and compliance related to WMO standards for observational data acquisition, data exchange and service delivery. The assessments will be undertaken in dialogue and collaboration with the NMHS. An integrated and practical WMO assessment methodology will be developed and applied, drawing from existing assessment tools, approaches and guidelines, including the WMO Capacity Development Strategy, the WMO Strategy for Service Delivery and WMO competency frameworks on service delivery"

^{vi} Tool development will also support the Presidents of Regional Associations to deliver on their Cg-18 Res 6 that tasks them to develop and establish an effective performance monitoring and evaluation process that will provide an objective assessment of attained capacity and performance of each Member.

^{vii} ToR of the assignment: "Develop a CSI assessment tool that supports senior level decision making, including of development and climate finance partners, on investments and resource allocation. The tool will: (i) Allow standardized assessment of NMHS capacity and performance incl. compliance with WMO standards; (ii) Be applicable for national meteorological, hydrometeorological, and hydrological services; (iii) Allow for benchmarking among countries; (iv) Build on experience from other sectors, including World Bank governance indicators and "Doing Business"; (v) Be "simple" and operational, i.e. has a very limited number of elements and is easy communicable"

^{viii} Potential complementary diagnostics for National Hydrological Services might be considered based on lessons learned from road-testing.

^{ix} [WMO Strategy for service delivery and its implementation plan, WMO-No. 1129](#), [WMO Capacity Development Strategy and Implementation Plan, WMO-No. 1133](#), [Capacity Development for Climate Services: Guidelines for National Meteorological and Hydrological Services, WMO-No. 1247](#), [Checklist for climate services, 2019 State of climate services, WMO-No. 1242](#), [WMO survey on hydrological capabilities, Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services, WMO-No. 1153](#), [Guide to the Implementation of Quality Management Systems for National Meteorological and Hydrological Services and Other Relevant Service Providers, WMO-No. 1100](#), [Guidelines on Quality Management in Climate Services, WMO-No. 1221](#), [Guidelines on the Role, Operation and Management of National Meteorological and Hydrological Services, WMO-No. 1195](#).

^x Developing countries as defined by WMO in its Strategic Plan 2020-2023 (LDCs, SIDS, lower and upper MICs)

^{xi} To be further developed as part of the road-testing. The Country Hydromet Diagnostics uses peer review as its approach. Peer reviews will draw on different data sources and data types. The basis for the peer reviews are available self-assessed and objective data. For some of the indicators (tbd) client-surveys will be undertaken.

^{xii} The GBON concept was approved by the 18th World Meteorological congress in June 2019. The detailed technical specifications are expected to be approved by WMO Members at the World Meteorological Congress in June 2021.