

WMO Global Hydrometry Support Facility Documentation

Executive Summary

Of all the environmental concerns critical to societal well-being, water is the most pre-eminent. Although other issues garner much justifiable attention, it is the availability of a stable, safe, and sustainable supply of fresh water that enables societies to survive and flourish, as well as supporting the agriculture, ecosystems, energy, and industry that they depend upon. Thus, as the 21st century dawns, it is not surprising that water is finally receiving the international attention that it deserves, especially through such endeavors as the United Nations (UN) Sustainable Development Goals (SDGs).

Significantly, however, for water to be of maximum benefit to society, it must be effectively managed; and effective management is predicated upon effective monitoring and data sharing. The challenge, of course, is to acquire, maintain, and share hydrological data on a regular and sustainable basis to meet the growing demand for such information across economic sectors and national borders.

Currently, coordination, innovation, research and development are needed to propose new approaches that: build, enhance, and maintain hydrological observing systems where they are weak; promote regional and global coordination of monitoring systems and product dissemination; support quality control, processing, exchange, and storage of observational data; generate derived products and develop information systems for related policy- and decision-support at relevant geographic and temporal scales; support the development of new data acquisition methodologies; and foster joint analysis of data in order to catalyse and improve trans-boundary and regional cooperation.

To meet this need, the World Meteorological Organization (WMO) proposes to establish a Global Hydrometry Support Facility (GHSF) designed specifically to build operational systems and capacity in hydrometry and water monitoring, expand the base of hydrological data and exchange capabilities, and facilitate free and open data sharing. It will do this through the development and application of innovative monitoring and database technologies, supporting regional and local projects aimed at building sustainable

hydrometeorological networks and freely accessible data, and promoting the use of quality management principles.

The primary elements of the GHSF are the **World Hydrological Cycle Observing Programme (WHYCOS)**, the **Global Innovation Hub (Hub)**, the **WMO Hydrological Observing System (WHOS)**, and a **Hydrological Services Information Platform**.

In addition, two critical support functions will be incorporated within the GHSF's framework: a Help Desk and an Advisory Council.

Importantly, the GHSF will provide the institutional mechanism for undertaking action that (1) consolidates national monitoring capabilities and their regional and global integration; (2) develops products and tools that support the analysis of data and information at national, regional, and global levels; and (3) focus on innovation and research leading to improved, fit-for-purpose and sustainable monitoring capabilities globally.

(1) Context

Sustainable water resources management is a global challenge in the 21st century. In its 2015 Global Risks report, the World Economic Forum ranked water crises as the highest global risk. Water is an essential prerequisite for protecting and fostering public health as well as for securing food and energy supply. Effective management of water, both in terms of quantity and quality is also a key element for preserving the integrity of our planets ecosystems, and thus for protecting the services aquatic ecosystems provide to our well being. Last but not least, water often plays a pivotal role in trans-boundary relations and can be origin of both conflict and cooperation at national and regional scales.

In order for water to be properly managed, it must be monitored. At the same time, monitoring results need be accessible and transparent to be useful for operational water management. Unfortunately, in many parts of the world, monitoring of water resources is poor and access to data and information is far from being free und unrestricted. The challenge is to acquire, maintain, and share hydrological data on a regular and sustainable basis to meet the growing demand for such information in development planning across economic sectors, to secure and protect life and property, to foster water cooperation and to provide a credible baseline data set for assessing and monitoring the state of the resource in relation to sustainable development.

In spite of numerous global initiatives aimed specifically at developing water-monitoring capabilities, data on water remain scarce, fragmented, and frequently difficult to access and interpret. Traditional water monitoring and management is too often a story of failures and inefficient investments. This seriously impedes efforts aimed at effective decision-support for integrated water resources management, particularly in areas where resource scarcity, fragile conditions, conflicts, highly variable supplies, and rapid demand growth overlap with underfunded agencies. It also tends to result in inferior and unsustainable outcomes that translate into water insecurity, which has significant adverse effects on communities, ecosystems and peaceful coexistence within the boundaries of shared resources. In addition, hydrological services often lack the established tradition of voluntary international cooperation, which has been a critical factor in shaping the development of well-functioning meteorological services worldwide.

The UN Secretary-General's High Level Panel report on the post-2015 agenda noted that a "data revolution" is needed to underpin the achievement of the post-2015 development goals. Coordinated and comprehensive observations are the backbone of any Earth information system. Indeed, hydrological data are essential to the verification of outputs and predictions from climate models as well as hydrological models at the global and regional scale.

Reliable hydro-meteorological observations and forecasts, packaged into appropriate, comprehensible products are critical to formulating and implementing integrated water resources management policies and strategies. This includes the effective construction, management, and operation of water infrastructure and for supporting effective planning and management across multiple socioeconomic sectors. Unfortunately, many countries are unable to provide accurate, timely, and coherent information and forecasts that meet user needs across the numerous sectors that would benefit from such products and services. Ultimately, this increases societal vulnerability to natural hazards and inhibits socioeconomic growth. Given the complexity of the hydrological services value chain at the national and regional level, in addition to differences in the socioeconomic and eco-hydrological objectives, appropriate investments to strengthen the national capacity to provide hydrological data and information services should be user demand driven.

Currently, coordination, innovation, research and development are needed to propose new approaches that:

- 1) build, enhance, and maintain hydrological observing systems where they are weak and where knowledge gaps are threatening sustainable development
- 2) promote regional and global coordination of monitoring systems and dissemination of their products/ benefits
- 3) support quality control, processing, exchange, storage of data from observing systems
- 4) generate derived products and develop information systems for related policy- and decision-support at relevant geographic and temporal scales
- 5) support the development of new data acquisition methodologies including and combining technology and community based approaches
- 6) foster joint analysis of data in order to catalyse and improve trans boundary and regional cooperation and support stakeholders in their capacity development in order to improve sustainable and secure water management

Recent advances in low-cost open-innovation sensor and communication technology, in hard- and software integration and in data synthesis, provide new perspectives through non-traditional, person-centered mobile sensing for increased data coverage, effective data management, and secure data exchange, as well as the production of knowledge for effective and sustainable resource management. Promoting the development and complementary use of these data, in conjunction with data from traditional monitoring stations and remotely sensed data, is at the core of the innovative monitoring and modeling (iMoMo) approach that the Swiss Agency for Development and Cooperation – Global Program Water Initiatives (SDC-GPWIs) has been promoting since 2012, and that has recently achieved proof-of-concept status in both Tanzania and Central Asia, as well as contributing to significant policy advances in both regions.

Accordingly, WMO proposes to establish a GHSF specifically to address many of the aforementioned weaknesses as well as to capitalize on the numerous opportunities arising from recent developments in innovation research and data and information technology.

(2) Relevance

The proposed GHSF is both timely and relevant to the goals of multiple international initiatives as well as directly addressing an identified weakness in a major WMO programme.

First, at its 17th session in 2015, WMO Congress endorsed the recommendation of an independent external review to establish a World Hydrological Cycle Observing System (WHYCOS) Office within WMO to “*address the shortcoming [that] still exist in the implementation of WHYCOS, in particular with respect to the sustainability of the systems installed*” and recognized the kind offer by SDC to fund the initial operations of such an office in association with the creation of a Global Innovation Hub for water resources measurement and monitoring. This decision provides a unique and incomparable opportunity for SDC-GPWIs to consolidate and upscale to the global level its iMoMo initiative, as well as several data management activities taking place under the Blue Peace and Hydrodiplomacy in hotspots projects.

Second, strengthening WMO represents a significant contribution to several national efforts such as the United Kingdom, Australia, and Norway’s South Asia Water Initiative, conducted in conjunction with the World Bank Group. This effort is designed to support countries improve and deepen transboundary dialog, enhance the basin and water resources knowledge base, strengthen water institutions, and support investments that lead to sustainable, fair and inclusive development.

Third, strengthening WMO as the lead UN agency for hydrometry will also make an essential contribution to UN Water’s post-2015 monitoring framework through the Global Expanded Monitoring Initiative (GEMI).

Finally, GHSF will provide critical support to the water, security, and peace agenda promoted by Switzerland and several partners by increasing the demonstrable relevance of water data and information to evidence-based decision making and trust building at national and regional levels, particularly, in conjunction with the Geneva Water Hub.

(3) Objectives

The long-term objective of the proposed programme is **to strengthen the WMO's global hydrometry mandate by developing an efficient, innovative and sustainable framework for operational hydrology**, in order to:

- o Enhance, consolidate and sustain global integration of national and regional monitoring systems, notably in relation to the Sustainable Development Goals (SDG) and the proposed water goal, as well as goal 11.5, ***at the global level***;
- o Foster evidence-based policy and decision-making from political, financial and operational standpoints, in support of integrated water resources management focusing particularly on transboundary settings and/or actual or potential water-related tensions and conflicts, ***at the regional and river basin level***;
- o Assist in the modernization and improvement of operational hydrology as the benefits provided by hydrological and related services depend on the existence of a sound and integrated observation, data processing, information production and service delivery system, ***at the national and local levels***.

To achieve this long-term objective, WMO will establish a GHSF designed specifically to build operational systems and capacity in hydrometry and water monitoring, expand the base of hydrological data and exchange capabilities, and facilitate free and open data sharing. It will do this through the development and application of innovative monitoring and database technologies, supporting regional and local projects aimed at building sustainable hydrometeorological networks and freely accessible data, and promoting the use of quality management principles.

(4) Implementing Strategy

Meeting the programme objectives as described above requires action on three levels:

- 1) consolidation of and support for **national monitoring capabilities** and their regional and global integration. This will be based upon an analysis of data gaps

and water conflict risks, and incorporate accepted international standards and data exchange agreements;

- 2) development of products and tools that support the analysis of data and information at **national, regional, and global levels**, and that meet the requirements of UN-Water, the Sustainable Development Goals (SDGs), and WMO, as well as supporting integrated water resources management; and
- 3) a focus on innovation and research leading to improved, fit-for-purpose and sustainable monitoring capabilities **globally**.

GHSF provides the institutional mechanism for undertaking action on all three levels by consolidating existing WMO programmes and capabilities, which address the first two action levels, and the SDC-sponsored iMoMo project, which addresses the third. At least through the transition period, the iMoMo consortium will provide an essential reservoir of expertise and experience for ensuring the provision of innovation-based capabilities to ongoing and incipient projects. The primary elements in this consolidation are:

- o **WHYCOS programme**, which largely focuses on capacity building to strengthen technical, human and institutional capabilities of National Hydrological Services (NHSs) in hydrological data collection as well as in the development and dissemination of information products. It does this at the regional level through the establishment of regional Hydrological Cycle Observing System (HYCOS) projects
- o The **Global Innovation Hub (Hub)**, which will extend the iMoMo project's focus on inventive technical solutions for water monitoring, will be established as a worldwide incubator for the development of new approaches to hydrometry (including surface water, groundwater, and water quality) through technology scouting, co-design, piloting, proofing, and compliance with quality management practices
- o The **WMO Hydrological Observing System (WHOS)**, which has recently been established as the world's premier online portal to near real-time and historical hydrological data made freely and openly available by NHSs around the world

- o A **Hydrological Services Information Platform**, which will evolve from the existing WMO Hydrological Information Referral Service (INFOHYDRO) meta-database and the incipient Global Assessment of Hydrological Services initiative of the World Bank, to provide potential funders of hydrometeorological projects with current information on governmental and non-governmental water monitoring organizations, their capabilities and structure, as well as their network and data sharing characteristics.

In addition, two critical support functions will be incorporated within the GHSF's framework: a Help Desk and the Advisory Council. The **Help Desk** will be an online support resource for GHSF stakeholders. It will be modeled loosely on the Associated Programme on Flood Management (APFM) Help Desk (http://www.apfm.info/?page_id=1253) and provide GHSF stakeholders and others with three types of online support: **Get Help**, where specialized assistance and guidance can be requested; **Help Yourself**, where tools, publications, educational materials, will be archived and stored for viewing online and downloading, as well as a Frequently Asked Questions section; **Provide Help**, where organizations can offer their potential for helping others.

The **Advisory Council** will provide critical consultative and review services to both the Innovation Hub and WHYCOS activities. Its primary purpose will be to provide guidance to the chief of the GHSF office on technology needs and opportunities, "hot spot" opportunities, and regional HYCOS opportunities and priorities. It will supersede the current WHYCOS International Advisory Group (WIAG) by incorporating the most essential functions of that group, and review proposals for both Innovation and HYCOS projects.

GHSF is designed to become fully functional after 2 years of transition from the modus operandi that HYCOS projects follow today. The GHSF project proposed for SDC funding is thus separated into a transition phase (Phase 1) and an operational phase (Phase 2) that will allow WMO to secure sustainable operation after the project support of SDC will end after 4 years.

Phase 1 – Transition (2016-2017)

1. Initial establishment of the Facility in the Climate and Water Department of WMO
2. Advertise for and hire GHSF Chief, innovation management and WHYCOS Office positions

3. Establish the Hub:

- Develop protocols and working arrangements for issuing calls for innovation proposals
- Develop explanatory and guidance materials targeted toward potential Hub project donors
- Implement a project evaluation and review mechanism based on independent peer review processes
- Provide backstopping framework for innovation projects as well as an interface for innovation projects and the more implementation oriented HYCOS projects
- Develop a communication strategy for the Innovation Hub
- Liaise with potential donors
- Develop close working relation to organizations, programs and projects that work on data standards, ontologies and semantics in order to provide a framework for improved data accessibility globally
- Prepare technical guidelines for improving free and un-restricted access to data and information
- Design a knowledge management system/platform that allows to communicate and assess all innovation projects and their outcomes

The iMoMo consortium will support the above mentioned activities with regard to drafting a first version of the GHSF innovation aspect strategy paper, designing a process blueprint for innovation, drafting a communication strategy, drafting a knowledge management concept and designing evaluation templates for the review of project proposals. Further, the iMoMo consortium will pilot the proof of concept of the innovation cycle of the GHSF including a call for projects and the peer review and selection of projects to be funded.

4. Establish the membership and terms of reference for the Advisory Council.

5. Develop and execute a plan for integrating the functions of the WIAG into the Advisory Council; and, when complete, dissolve the WIAG.

6. Re-organize the existing WHYCOS functions in the WMO Secretariat into the new GHSF WHYCOS Office.

- Consolidating existing WHYCOS project documentation
- Linking existing WHYCOS projects to the Innovation Hub

- Providing transparent, consistent and long term information on success and shortfalls of WHYCOS projects
 - Development of a WHYCOS/Innovation Hub matrix of potential development and testing priorities
 - Develop a set of capacity development materials, tutorials, online resources
 - Organize inter-calibration and quality assurance procedures and operations
7. Maintain WHOS phase 1 map interface product, and develop and implement the WHOS phase 2 web services interface with WIS.
 8. Develop and implement an online Hydrological Services Information Platform, in conjunction with the current World Bank assessment of NHSs, making use of existing material from INFOHYDRO as appropriate.
 9. Develop and implement the online GHSF Help Desk.
 10. Design, issue, and maintain a GHSF website.

Phase 2 – Operational (2018 onwards)

By 1 January 2018, if not sooner, the GHSF will have evolved to the point where all of its components are in place, functioning, and interacting as depicted in Figure 1:

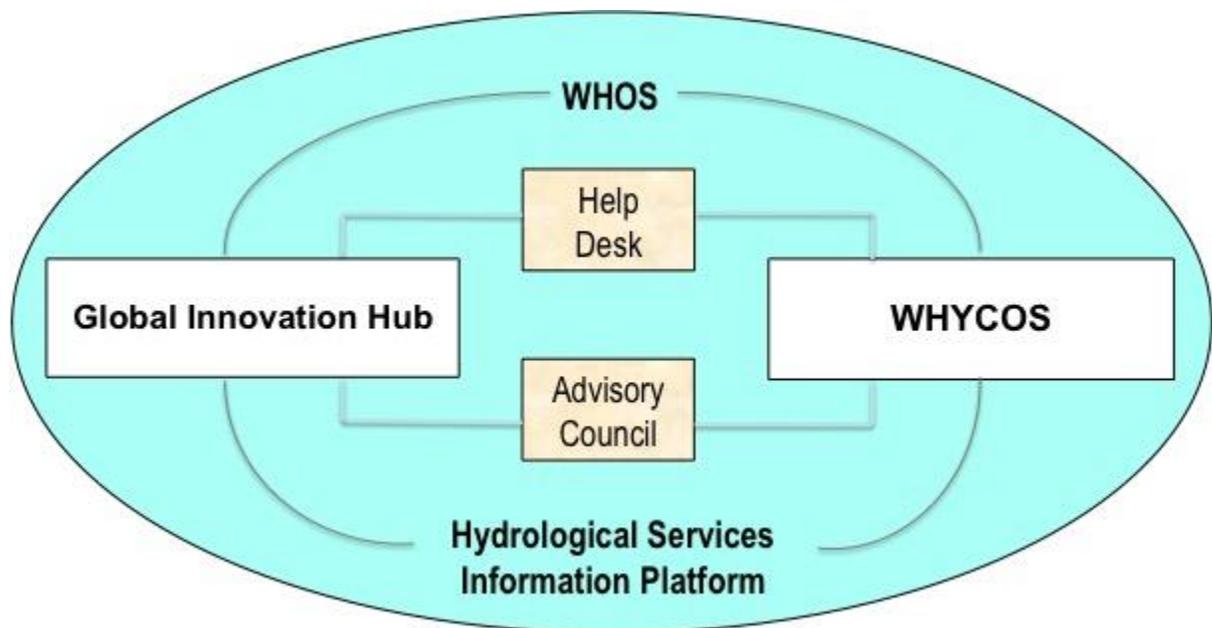


Figure 1. Components and internal linkages of the WMO Global Hydrometry Support Facility.

The GHSF's two core incubator functions are reflected in the Global Innovation Hub and the WHYCOS programme. The Hub issues calls for innovation, coordinates with projects and donors and, together with WHYCOS coordinates the testing and implementation of new monitoring technology and methodology in HYCOS projects. WHYCOS coordinates and develops monitoring networks that are needed for water management and monitoring sustainable development. WHYCOS also provides training and education for all relevant stakeholders. WHYCOS, together with the Global Innovation Hub organizes and coordinates the development of tools and data products that are necessary for monitoring and management.

Stakeholder access to GSHF is secured through WHOS, the NHS Information Platform and the Help Desk. WHOS provides a global one stop shop for data and information with regard to hydrological data and monitoring. The NHS Information Service contains up to date information on National Hydrological Services and serves as an entry point for stakeholders from the full spectrum of water related issues in SDG's, the Global Framework for Climate Services (GFCS) and the Group on Earth Observations (GEO) and further relevant frameworks and programs. The Help Desk will serve as a platform to distribute practical information and knowledge on water monitoring. It also provides chances to initialize and maintain regional and bilateral cooperation on monitoring related issues. Key stakeholders of the GHSF are, amongst others, national operational services, river basin authorities, global and regional data centers, research groups/institutions that make use of data, developers of new technology, providers of education and training programs that relate to hydrometry, water related non-governmental organizations (NGOs) and United Nations Organization (UNOs).

Development of GHSF is secured through the Advisory Council that provides guidance for the GHSF office and ensures that the GHSF is visible at the relevant political levels.

(5) Organization, Management and Administration

The GHSF is organized under the broad framework of WMO's Climate and Water (CLW) Department as depicted in Figure 2. The Facility operates as a component of the Basic Systems in Hydrology Division, under the overall management of the WMO Director for

Climate and Water. The P4 level GHSF coordinator will oversee the work of the WHYCOS and Innovation Hub project specialists. The incumbent will report to the chief of the Basic Systems in Hydrology division. He/she will liaise with scientific partners, donors, National Hydrological Services as well as other relevant organizations, e.g. regional or river basin organizations. Two project staff positions at the P2/3 level will help the coordinator to produce the fully fledged framework of the facility in the transition phase. Once the GHSF is fully operational they will operate the helpdesk, further the development of standards and semantics, update and maintain WHOS, update NHS Information platform regularly, produce and process calls for innovation under the guidance of the Advisory Council, support the Advisory Council meetings, provide assistance with secretariat matters in WMO and serve as support/liaison staff for WHYCOS and Global Innovation Hub projects.

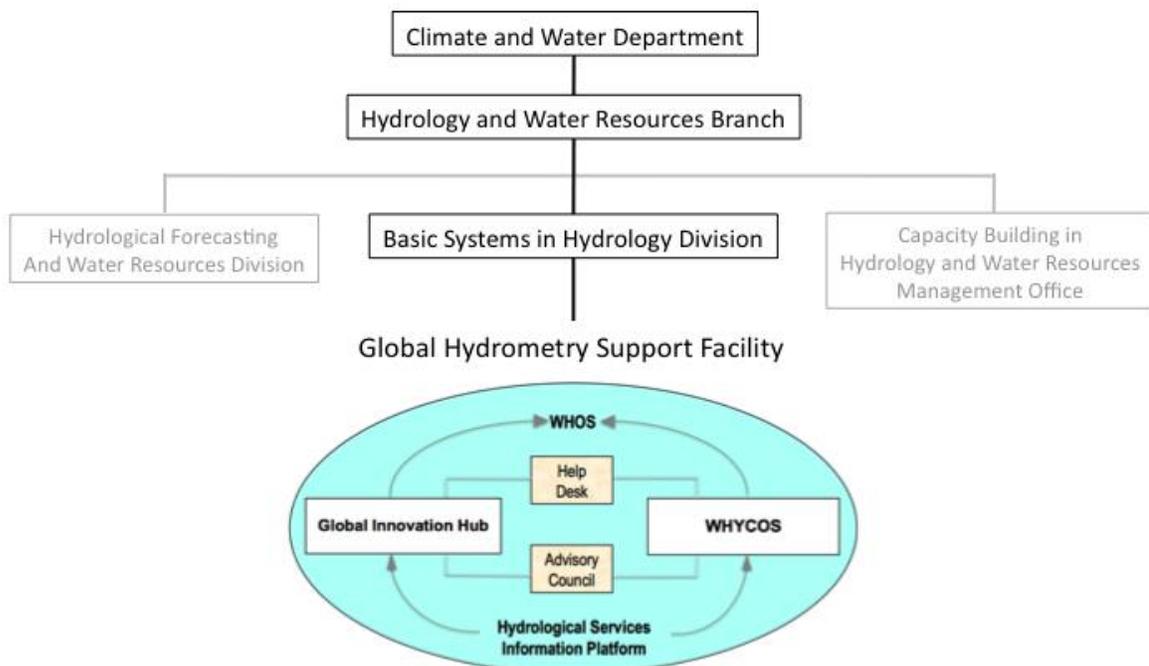


Figure 2. Organization of the GHSF within the WMO Climate and Water Department.