WMO and the World's Water

World Meteorological Organization
WMO-No. 878

What is the World Meteorological Organization?

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What is its purpose?

The primary purposes of WMO are:

- To facilitate the development of services that improve the well-being and safety of communities, nations and the whole of mankind; and
- To coordinate the activities of its Members (countries) in the generation and exchange of information on weather, water and climate, according to internationally-agreed standards; related research at national, international and global levels; and the training of professionals and technicians to internationally-recognized levels.

Why is it important?

Weather and climate know no national boundaries. International cooperation at a global scale is therefore essential for the development of meteorology and operational hydrology, particularly in support of water resources assessment.

Nearly three-quarters of all natural disasters are weather-related. WMO and its programmes provide the vital information for the advance warnings and flood forecasts that save many lives and reduce damage to property and the environment. Numerous studies have shown that, apart from the incalculable benefit to human well-being, every dollar invested in Meteorological and Hydrological Services produces an economic return many times greater, often 10 times or more.

How does it function?

Every four years, all Member countries send representatives to the World Meteorological Congress, which determines the future policy and four-year programme and budget of WMO.

The Executive Council, composed of 36 directors of national Meteorological or Hydrometeorological Services (NMHSs), meets once a year to review the activities of the Organization and to implement the programmes approved by Congress. Six Regional Associations allow Members to address their regional concerns. Eight Technical Commissions bring together the world's foremost experts in aeronautical, agricultural and marine meteorology, climatology, hydrology, atmospheric sciences, instruments and methods of observation, and the basic systems underlying meteorology. They provide detailed technical advice and recommendations for the work of WMO and for all of the Meteorological and Hydrological Services of the world.

WMO achieves all its success through the work of its Members, coordinated by a Secretariat headed by a Secretary-General who is appointed by the World Meteorological Congress.

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NOTE

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Meteorological Organization concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

FOREWORD

The world's freshwater is a precious resource that is essential for all forms of human activity and for life itself. Over the past two decades, increasing concern has been expressed over the growing agricultural, industrial and domestic demands on this limited resource. Water shortages, water pollution, the provision of a safe supply of freshwater and adequate sanitation, and tensions between States sharing common water sources, are problems that will be amplified as the global population increases. It is therefore the responsibility of governments and civil society to manage this resource in a sustainable manner for economic and social well-being.

For this purpose, there is a need for reliable data and information on the available quantity and quality of freshwater, and its variation in space and time. The natural link between weather and water therefore calls for close cooperation between the meteorological and water communities at national and international levels. For this reason, the World Meteorological Organization (WMO) has the responsibility within the United Nations system for operational hydrology, including matters relating to the collection and processing of water-related data, and assessments of the current and future availability of freshwater resources, including concerns about the possible impact of climate change.

Carrying out these functions is the role of the national Meteorological and Hydrological Services (NMHSs), which play an important part in assisting Governments in the management and development of water resources, and in providing advanced warnings against droughts and floods. WMO, for its part, actively collaborates with these Services and international bodies in striving for an improved hydrological knowledge base, and greater regional cooperation in the planning, management and use of this vital resource. This is an obligation we must all undertake for the benefit of future generations of humankind.

(G. O. P. Obasi)
Secretary-General

Life on this planet would not be possible without the presence of water. Hydrology, meteorology and climatology are interrelated areas linked by the hydrological cycle. Precipitation as rain and snow provides the source of the water that flows in the world's rivers, is stored in lakes, and replenishes the groundwater supplies. Hydrology and meteorology are closely linked in the preparation of a flow forecast, conducting a water resources assessment or determining the impact of climate change on the water resource.

Les Schöllenen in Uri, Switzerland. (M.C. Mermillod)

What are the global water problems and challenges?

Of all the Earth's water, 97.5 per cent is salt water, leaving only 2.5 per cent as freshwater. Nearly 70 per cent of all freshwater is frozen in the ice caps of Antarctica and Greenland, and most of the remainder is present as soil moisture, or lies in deep underground aquifers as groundwater not accessible to human use. As a result, less than 1 per cent of all water on Earth is readily accessible for direct human uses. This is the water found in lakes, rivers, reservoirs and those underground sources that are shallow enough to be tapped at an affordable cost. Only this amount is regularly renewed by rain and snowfall, and therefore available on a sustainable basis.

Human pressures on the freshwater resource have grown considerably. There has been a six-fold increase in water use this century, growing at a rate two and one-half times the rate of population increase. The increase in use of water for irrigation is responsible for a large part of the growth, but as incomes rise the use per person increases as well. Industry and urban use also continue to rise.

In 1995 an estimated one-third of the world's population lived in countries experiencing moderate to severe water stress. By 2025 this is expected to rise to two-thirds, with a large part of the increase occurring in developing countries, where the adjustment required to balance supply and demand will have major social and economic impacts.

Twenty per cent of the world's population lacks access to a safe water supply, while 50 per cent lacks access to adequate sanitation. It has been estimated that 5 million people die each year from diseases caused by unsafe

drinking water and a lack of access to adequate sanitation and water for personal hygiene.

The world's waters are becoming increasingly polluted. This effectively reduces the availability of clean, safe water and affects the health of humans and the aquatic ecosystem. In some areas the level of pollution from land-based sources is great enough to reduce the fisheries in coastal and nearby ocean areas. Pollution and lack of water are particularly severe in rapidly growing urban centres and mega-cities, where more than 50 per cent of the world's population will live by the year 2025.

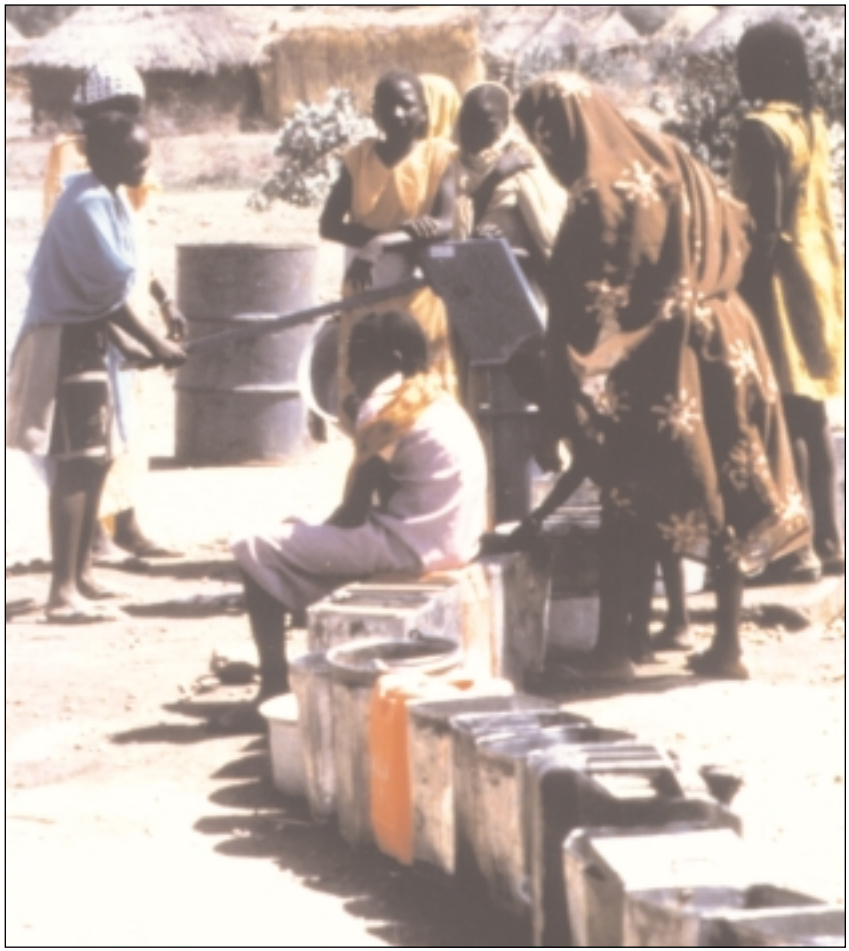
The prognosis is bleak, but a crisis is not inevitable. Meaningful actions now can reverse the present trends. Water supply and demand can be brought into balance by a greater emphasis on conservation and more efficient water use. Land and water use, and allocation to specific purposes, can be changed for the better. Pollution can be reduced and the environment protected.

How can hydrological information contribute to sustainable development?

Hydrological information has been used for thousands of years. For example, the "nilometer" was used in ancient Egypt to measure the height of the floods, and this information was used to determine planting patterns and crops. Information on both normal conditions and on the extremes of flood and drought has shaped civilizations and public works for many centuries.

Most human settlements have developed along waterways, which served as the transportation corridors and sources of water for crops and other uses. Because of this dependency, it became necessary to collect information on water levels, river flow, sediment and water quality for flood protection, reservoir construction, water supply, hydropower development and navigation.

More recently, a number of environmentally-oriented purposes for collecting hydrological information have become increasingly important. These include reducing pollution and protecting fish, wildlife and biodiversity.



Villagers in Sudan line up for water. (UNICEF)

Without adequate long-term information, much higher costs are incurred in the construction of water projects because of the need to account for uncertainty in design. Poor decisions may also be made as to the amount and quality of water that is actually available. Other alternatives, such as improving efficiency or reducing demand, may not be given proper consideration. The cost of an effective programme of data collection and information management need only be a very small percentage of the cost of water resource projects that depend on these data.

Hydrological information is also important for flood forecasting and evaluating the impacts of climate change. The economic costs of natural disasters such as floods are rising dramatically. Between 1990 and 1996 there were 22 major flood events in which the damages exceeded more than 1 000 lost lives or more than US$ 1 billion. The rising toll in damages is partly due to increased development in flood plains, but may also be due to man-made influences such as change in land use, deforestation and climate change.

Hydrologists monitoring the water level of a river in New Zealand. (P. Mosley)

Nineteen ninety-seven was a particularly bad year for flooding. In April, major flooding occurred in the Red River basin of the north-central United States and Canada; in July, there was widespread flooding on the River Oder in Poland and eastern Germany, and the "flood of the century" in the Czech Republic; and from June to August, there was widespread flooding in China.

What is the role of national Hydrological Services(NHSs)?

NHSs are the backbone of the painstaking work of collection, interpretation, analysis and distribution of hydrological information. Their structure varies significantly from country to country — there may be a single central water resources agency, an agency combined with a national Meteorological Service (NMS), or several agencies sharing responsibilities for Hydrological Services. In some countries, responsibility is decentralized to provincial authorities or even individual river basin authorities.

Some of the typical uses for hydrological and water resources information include:

- protecting people and property from floods and droughts;
- assessing the quantity and quality of available water resources;
- planning, designing and operating water projects;
- determining the environmental, economic and social impacts of management practices; and
- determining the impacts of urbanization or forest practices on water resources.

An analogy can be drawn between NHSs and banks. For example, banks make available the financial resources and expertise

which enable businesses to function and grow. NHSs make available knowledge of the water resources that allows projects to be built, management activities to take place or projects to operate more efficiently.

More and more NHSs are being called upon to move beyond traditional functions and to participate in decision-making related to water resources management and development at the national level. They are being asked to develop policy positions and evaluate for their countries the impacts of climate change and other factors, such as desertification.

NHSs can offer substantial economic benefits in terms of better decision-making and protection of health and safety. A number of economic studies have demonstrated that benefits exceed costs by a factor of five to 10. Even then the benefits are probably underestimated, because of the difficulty of putting a value on the in-river and lake ecosystems. Just the fact that a clean water source is there and can be used has recreational, social and aesthetic values. Benefits can go even higher for specific functions, such as flow forecasting.

NHSs contribute expertise and knowledge to the work of WMO, and also benefit from the exchange of information, guidelines and capacity-building activities within WMO. As shortages and other water problems become more regional and international in scope, WMO can help by providing information on the many initiatives, and also gauge the country response to such initiatives in measurable terms.

How are WMO water activities structured?

Most of the water-related activities of WMO are managed and delivered by its Hydrology and Water Resources Programme (HWRP). The programme is defined to cover the following topics:

- measurement of basic hydrological elements from networks of meteorological and hydrological stations — collection, transmission, storage, retrieval, and publication of basic hydrological data;
- hydrological forecasting; and
- development and improvement of relevant methods, procedures and techniques in support of the above.

The main interest of the HWRP is centered on the operational use of hydrology, both with regard to basic systems and to forecasting, and on the assessment of the quantity and quality of water resources.

The HWRP also contributes to various other WMO programmes, which have important hydrological components. These include the Tropical Cyclone Programme, the World Climate Programme, the Instruments and Methods of Observation Programme and the Regional Programme. These programmes in turn contribute to the HWRP, as does the World Climate Research Programme, particularly through the Global Energy and Water Cycle Experiment and its various projects. The HWRP also incorporates and supports a wide range of activities related to education and training in hydrology. Furthermore, WMO's technical cooperation activities include a substantial hydrological component, to which the HWRP provides technical support.

The HWRP was designed to respond to the overall priorities established by the United Nations Water Conference (Mar del Plata, 1977) and by the expressed needs of Members. The International Conference on Water and the Environment (Dublin, January 1992); the United Nations Conference on Environment and Development (Rio de

Flood waters in Lisbon, Portugal, November 1983. (IDNDR)

Janeiro, June 1992); the WMO/Economic Commission for Africa (ECA), African Conference on Water Resources: Policy and Assessment (Addis Ababa, March 1995); and the WMO/Inter-American Development Bank Conference on Water Resources Assessment and Management Strategies for Latin America and the Caribbean (San José, May 1996) brought fresh concepts and requirements from Members. These conferences also put increased emphasis on the sustainable development of water resources, the problems of natural hazards and on the promotion of sound environmental management.

Furthermore, the Special Session of the United Nations General Assembly (New York, June 1997), after its review of freshwater issues, made a specific recommendation for strengthening the capabilities of Governments and international institutions to collect and manage information, including scientific, social and environmental data, in order to facilitate the integrated assessment and management of water resources. Consequently, the emphasis and direction of the HWRP has been changed to respond to the concerns of these recent events in order to provide an appropriate follow-up in the freshwater area. In this context, the increasing involvement of women in hydrology and water resources activities also needs to be emphasized.

In conclusion, the fundamental role of the HWRP is to be at the leading edge of the operational hydrological practice, to be involved in international initiatives related to freshwater, and to assist the NHSs in fulfilling their responsibilities.

Recent areas of activities

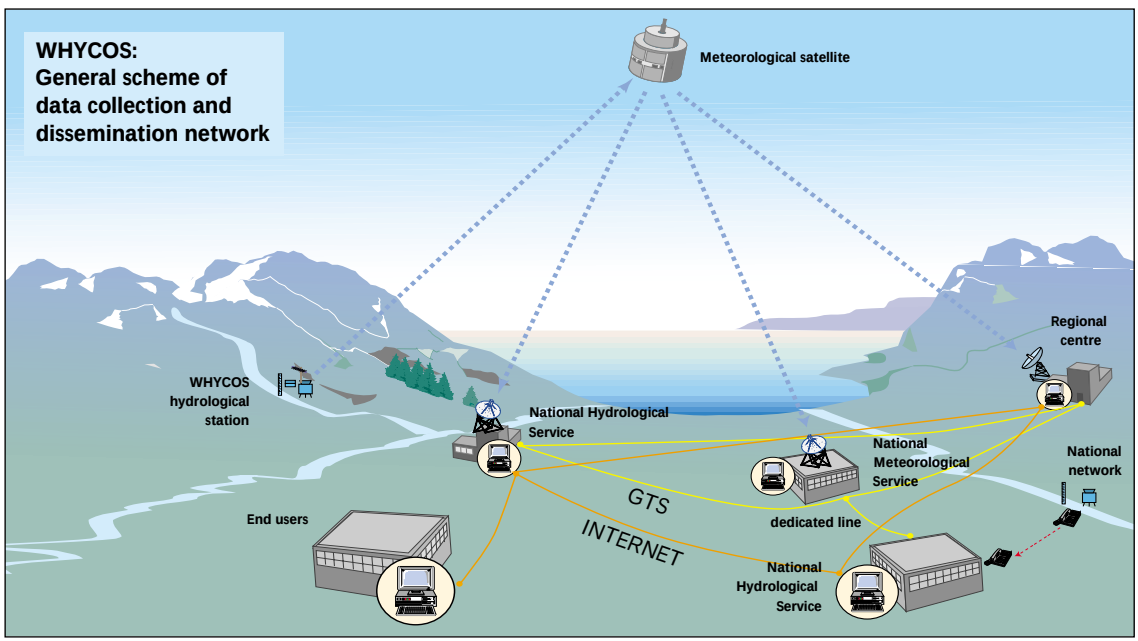
As one of WMO's Technical Commissions, the Commission for Hydrology (CHy) provides the broad-based scientific expertise and guidance to address matters of importance to Member countries. Recent areas of activity have included integrated hydrological networks, hydrological forecasting systems, hydrological aspects of natural disasters and environmental issues, assessment of water use and the latest in hydrological technology. This information is incorporated into technical standards, reports or guidelines that can be used by NHSs in their work. The activities of the Commission are

often undertaken jointly with activities of specific interest to each WMO region through the Working Groups on Hydrology of WMO's six Regional Associations.

Another recent initiative, the World Hydrological Cycle Observing System (WHYCOS), was launched by WMO in cooperation with the World Bank, the European Union and other donors to improve the availability of "real-time" hydrological information for operational purposes. WHYCOS consists of a global network of reference stations, which transmit hydrological and meteorological information data in near-real time, via satellites, to NHSs and regional centres. WHYCOS aims to support, in all parts of the world, the establishment and enhancement of information systems, which can provide reliable water-related data to resource planners, decision-makers, scientists and the general public.

WHYCOS is being developed in the form of regional components, HYCOSs, which meet priorities expressed by the participating countries. In its initial phases, it has focused on establishing components in international river basins, in the catchments of enclosed seas, and in regions of Africa that are poorly served by hydrological information.

A number of other specific activities within the HWRP are designed to assist in capacity building. For example, the Hydrological Information Referral Service (INFOHYDRO) contains information on national, regional and international networks, data centres and hydrological agencies. The Hydrological Operational Multipurpose System (HOMS) facilitates the exchange between countries of hydrological technology such as computer software, technical manuals and other support material.



Finally, the increasing awareness of global water issues has resulted in a shift of activities within the HWRP to build partnerships with other United Nations and external support agencies. The programme has played a major role in support of efforts to galvanize international attention on the global freshwater issues through publications and media events, participation at ministerial and expert group meetings and conferences, as well as at sessions of the United Nations Commission on Sustainable Development (CSD). In addition, the HWRP is a participant in the World Water Council and the Global Water Partnership, two new initiatives in the international arena.

The challenges ahead

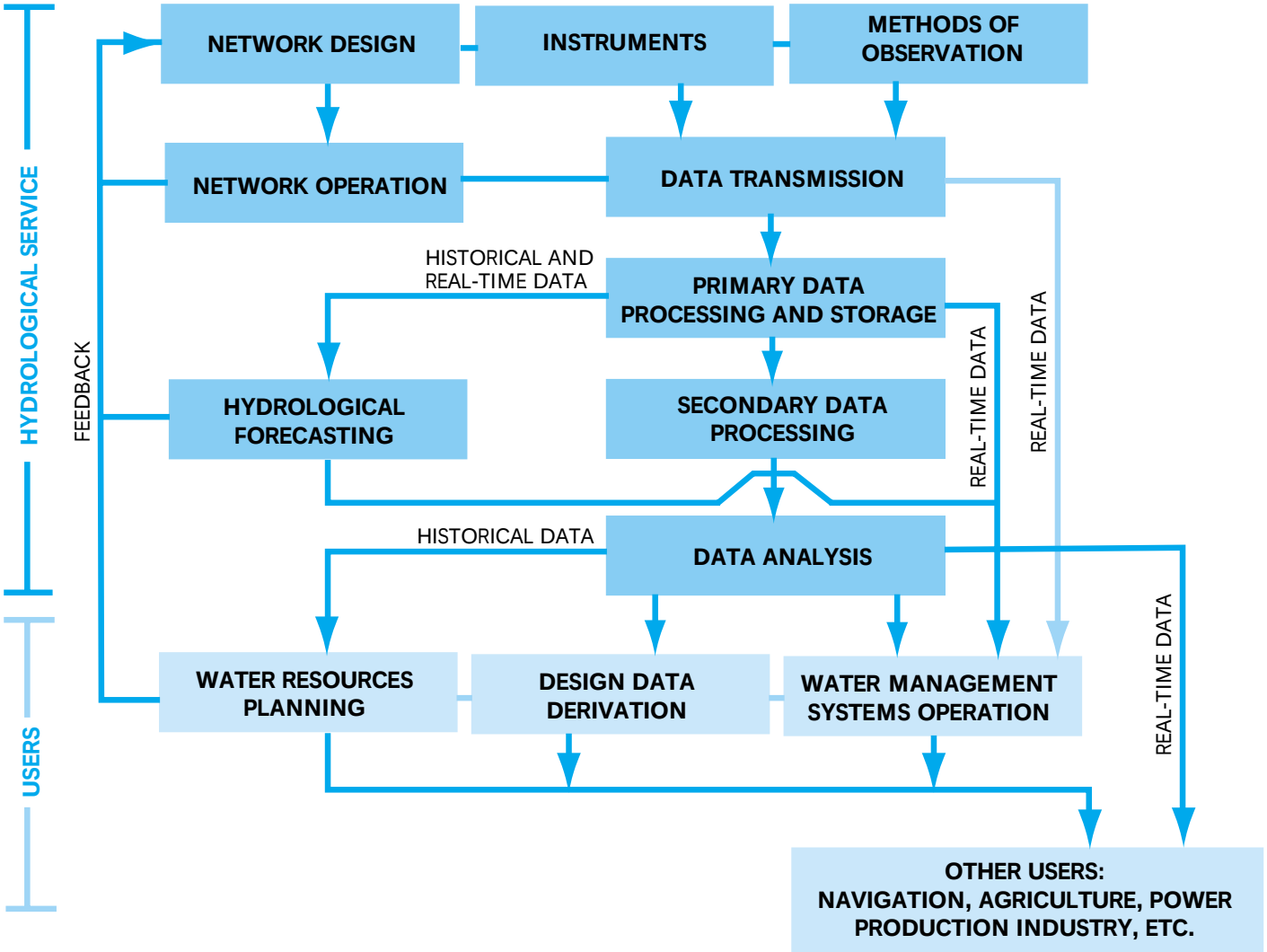
Perhaps the biggest challenge of all for the water programmes in WMO is trying to keep pace with the rate of change, and the increased priority given to water issues at the national, regional and international levels. NHSs are being restructured to make them more effective and responsive to user needs. New technology for collecting, interpreting, archiving and disseminating information is being introduced at a rapid pace. Sustainable development requires the integration of water information with land, demographic, economic and environmental information. This integration requires the development of new and broader partnerships both at national and international levels.

Certainly the global freshwater agenda will be a tremendous and pressing challenge. Much is expected of both governments and United Nations agencies in terms of follow-up to the Ministerial Conferences and the CSD activities of 1998. Capacity building, a prime activity of WMO, has been emphasized by all concerned, and significant support to NHSs in developing countries will be of utmost importance.

Understanding the impacts of the climatic phenomenon “El Niño”, or the impacts of climate change on the variability of water supply, requires a new set of tools and scientific understanding. Often, insight can only be gained through major international initiatives, which then have to be interpreted and understood at the management level of a basin or country. One cannot rely entirely on an extension of past hydrological events to judge the severity of what might happen in the future.

New players in the water arena are emerging who deserve a voice, such as the non-governmental organizations, basin authorities, donor agencies and community-level organizations.

WMO stands ready to meet these new challenges with the same sense of purpose it has shown for more than a century.



A hydrological information system.

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