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WATER RESOURCES INFORMATION SYSTEM: WHYCOS A BASIC TOOL FOR INTEGRATED WATER MANAGEMENT

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1. BACKGROUND

While the pace of development is accelerating in many parts of the world, there is also growing and widespread pressure for increased protection of the environment. To reconcile these differing thrusts and to satisfy a number of other aspirations, the **United Nations Conference on Environment and Development (UNCED)** was held in Rio de Janeiro in June 1992. UNCED produced a blueprint for the future of this planet, namely **Agenda 21**, which addresses the problems of today to prepare for the coming challenges.

One matter which became clear was that a common and adequate knowledge base is lacking in many areas where judgement of priorities and far reaching decisions are needed. Amongst the most important of these is the area of fresh water since few other resources affect so many areas of the economy and of human and environmental health.

The **ESCWA region** belongs mainly to the arid and semi-arid zones. Some of the countries of the region are at present facing water shortages hampering their socio-economic development and according to recent UN projections many of the countries of the region will experience chronic scarcity of fresh water in the near future.

2. NEED FOR WATER RESOURCES INFORMATION SYSTEMS

Both the fresh water chapter (Chapter 18) of Agenda 21 and the Report of the **International Conference on Water and the Environment (ICWE 1992)**, on which it was based, recognize that knowledge of the hydrological cycle, in terms of both quantity and quality, is the essential basis for effective integrated water management.

These same sentiments are reflected in a number of other similar documents (IUCN 1991, Dooge, et al 1992, World Bank 1994). These reports indicate the need for monitoring systems, including data archives, for water resources assessment and for pollution protection and control. They identify the importance of communicating information on water to decision-makers and to the general public. They insist on the necessity to develop co-operation and co-ordination at the regional and interregional levels through appropriate information systems for the integrated management of shared water resources.

However, Chapter 18 and the ICWE Report also recognize that the monitoring systems and the Hydrological Services that operate them **are in decline in many parts of the world** (WMO/UNESCO 1991), largely because of budgetary constraints but also because decision-makers and the general public are normally not aware of the economic value of very high quality and timely available data and of **the dependance of water development on modern information systems in the field of water resources.**

These problems continue despite the **international programmes** promoted by WMO, UNESCO and other agencies, regional organizations and bodies. They also continue despite parallel **regional and national initiatives**, in many case, initiatives stimulated by technical assistance programmes funded by donors.

Records of river flows from around the world are collected at the **Global Runoff Data Centre (GRDC)** in Koblenz, Germany. A similar collection of water quality records is carried out by the **WHO Collaborating Centre on Surface and Ground Water Quality at Burlington**, Ontario, Canada. The first of these centres comes under the aegis of WMO, with UNESCO co-operation, the second has UNEP, UNESCO, WHO and WMO involvement. However, neither of these centres has adequate coverage of the globe, in terms of the countries concerned, nor in terms of the duration of the data sets and the data are of variable quality. For these reasons, it is extremely difficult to employ these data, even with additional international or national data sets, to assess comprehensively the world's water resources over the long term. To undertake this task for a particular decade, a year or a month is an impossibility. An entirely fresh approach is needed.

3. THE WHYCOS INITIATIVE

As a contribution to address this situation, WMO with the support of the World Bank and other agencies, has developed and promoted the concept of a **World Hydrological Cycle Observing System (WHYCOS)** which will be implemented to act as a tool for the improvement of collection, dissemination and use of high quality, standardized and consistent hydrological and related information at a national, river basin, regional and international levels for development purposes.

WHYCOS would establish a **basic network of benchmark, or reference stations throughout the participating countries.** These stations would generally be selected sub-sets of the existing station network agreed with the national agencies. These stations would almost always be existing stations with long records. All stations contributing to the WHYCOS network would be upgraded to common minimum standards, such that users of the database could be assured that the data met assured standards.

Stations would transmit **data in real time** using modern Data Collection Platforms (DCPs) with data being transmitted from field stations to national, regional, and possibly international, centres via satellites, generally those geostationary satellites intended primarily for meteorological observations. Existing

segments in the **WMO Global Telecommunication System (GTS)** of the **World Weather Watch (WWW)** will also be used, where these are available.

Raw data would be available to users in real time, but the national hydrological agencies responsible for each contributing station would subsequently validate and quality control the data, according to agreed WHYCOS criteria, which would then be stored on the database with flags to indicate that the data have been checked.

All these stations would **measure routinely a common core set of variables** comprising for example: river level/flow, rainfall, the climatic variables required for estimation of potential evaporation using the Penman equation, selected basic physio-chemical parameters of water (see Table 1). Users would be involved in the selection of this standardized core set of variables and of any additional ones, taking into account the technological limitations.

The WHYCOS database would be a distributed one, with operational centres at national and regional centres. The **data belong to the participating countries** and must be managed at this level. Once a year or more frequently according to the needs, historical data from selected stations should be passed to GRDC for archiving and to other international centres. In addition to the key role of managing the global database, which is seen as essential to address the goals of large scale phenomenon, the GRDC could assist in the definition of operational guidance and to support the national and regional operational centres, notably through training within its field of competence.

As stated above, the data would be stored on a series of distributed, but linked databases. These would be at national and regional levels, but these **databases should be linked using some sort of flexible, easy-to-use communication network, such as the World Wide Web on Internet.** Such network communications would also extend to other related data sets such as those maintained under the **Global Climate Observing System (GCOS),** the **Global Terrestrial Observing System (GTOS),** the **Global Environment Monitoring System (GEMS)** and the **Global Ocean Observing System (GOOS)** programmes, and to the databases maintained by the GRDC at Koblenz and by the **Global Precipitation and Climate Centre (GPCC)** in Offenbach, and the **FRIENDS'**data bases.

It is proposed that **basic data held on the WHYCOS databases should be available free of charge to users.** However, any **derived products,** such as maps of specific runoff, hydrographs, results of analyses and so on, **would be charged for** in order to **generate an income stream for national hydrometric agencies.** Such a system would help to create a sustainable data collection and dissemination service.

Capacity building would be part of WHYCOS activities. Therefore the needs for qualified experts would be assessed and relevant initiatives to improve and/or to sustain the situation would be developed, not only in the field of training which is only one of the way to build the national capacities.

WHYCOS has already been **endorsed by the Commission for Hydrology (CHy)** during its ninth session held in January 1993. **The Executive Council (EC) of WMO** during its forty-sixth session, in June 1994 expressed the view that WHYCOS was potentially of great importance to water resources assessment on the global, regional and national scales and that WHYCOS should be given more prominence in the long-term plan of WMO. More recently, **the Eleventh Session (Paris, 30 January - 4 February 1995) of the Intergovernmental Council of the International Hydrological Programme of UNESCO** adopted a resolution which called upon the Director General of UNESCO to arrange, in cooperation with WMO, for the planning and implementation of WHYCOS.

The Twelfth Congress of WMO (30 May-21 June 1995) in Resolution 20 (Cg-XII) notably encourages Members "to facilitate the establishment of WHYCOS through the implementation of national, sub-regional and regional components of the system."

Furthermore, WHYCOS is one of the responses of WMO to the **UN Commission on Sustainable Development (CSD)**, which during its second session (May 1994) urged "UNEP, FAO, UNIDO, WHO, WMO and UNESCO, in collaboration with UNDP, the World Bank and other relevant bodies, to strengthen their efforts towards a comprehensive assessment of freshwater resources, with the aim of identifying the availability of such resources, making projections of future needs and identifying problems to be considered by the 1997 Special Session of the General Assembly".

4. MED-HYCOS A REGIONAL COMPONENT OF WHYCOS

The implementation phase of the **Mediterranean Hydrological Cycle Observing System** (MED-HYCOS) started when, upon the kind invitation of the District and City of Montpellier (France), representatives of 20 countries in the Mediterranean Basin as well as representatives of FAO and UNEP and of non-governmental organizations attended a scientific and technical meeting jointly organized by the World Meteorological Organization (WMO) and the World Bank (Montpellier 17 to 19 May 1995).

The meeting agreed that MED-HYCOS will be a regional system composed of three fully integrated sub-systems respectively for data acquisition; data storage, retrieval and processing; and data and information exchange and dissemination. The objectives of the system have been prioritized by the meeting as follows:

- To modernize hydrometeorological monitoring region-wide and promote exchange between Hydrological Services,

- To achieve a better understanding of regional hydrometeorological phenomena and environmental trends,

- To encourage free exchange of quantitative and qualitative hydrological data as well as environmental data.

The meeting also agreed that such a system would help improve water resources assessment and management in the countries of the Mediterranean Basin, besides strengthening the collaboration and co-operation between hydrologists and between the national services in charge of hydrology and water resources throughout the basin. Participants also emphasized that MED-HYCOS should contribute to the knowledge of hydrological processes, in particular their interaction with the climate and environment, and should play a role in the monitoring and the abatement of pollution in the Mediterranean Sea. Therefore, they agreed to a request of representatives from the Black Sea countries to extend the system to the Black Sea Basin which is heavily polluted and has a hydrological connection with the Mediterranean Sea.

Data acquisition would be made through a **network of 150 standardized DCPs**, installed at key stations equipped with automatic sensors for the measurement of some **sixteen variables** related to water quantity and quality and climate, transmitted in real time through the **METEOSAT Data Collection System (DCS)**.

After a detailed review of a concept paper, prepared by WMO on the basis of a questionnaire which was circulated to all countries and to various international, regional and non-governmental organizations during the second half of 1994, the participants adopted the draft detailed implementation plan and work plan proposed by WMO, as the Executing Agency for the project.

The participants decided that a **Pilot Regional Centre (PRC)** should be created to implement the different activities related to the project, notably the preparation of the technical specifications for the equipment, the development of data-management and processing software for the raw data, the development of a regional data base, the organisation of training courses, etc. These tasks will be undertaken under the supervision of a **Regional Cooperative Group (RCG)** comprised of the representatives of the participating countries, regional organizations concerned, funding agencies and donors, as well as the World Bank and WMO. An **initial co-ordinating team** with representatives from Bulgaria, France, Italy, Malta, Romania, Spain and Tunisia and representatives of WMO and regional non-governmental organizations has been created to support the PRC.

The meeting accepted the offer made by the **French Scientific Research Institute for Development in Co-operation (ORSTOM)** to host the PRC, which will serve as a focal point of a dynamic network grouping the MED-HYCOS project partners.

Thanks to the World Bank which has made available to WMO **US $ 500,000 as the first part of a total grant of US $ 1,700,000**, the installation of the first 20 DCPs is expected to be completed by the end of this year or in the beginning of next year. **Spain, Italy and Malta have already expressed their willingness to**

support the project and additional funds will be sought from international sponsors, such as the European Union. At the same time as the first DCPs are going to be installed and people trained in the use of the new equipment, an Internet-type communication network will be completed to link all the participating bodies to each other and to the PRC. The first products of the system are expected to be available by the second half of 1996.

5. CONCLUSIONS

Sustainable development and meaningful environmental protection are both dependent on effective water resources management, which in turn is dependent on data particularly reliable hydrological data. Currently such data are not readily available globally, regionally and even nationally for a number of nations.

WHYCOS is intended as **a key element in the strategy of the international community for combatting the approaching water crisis through capacity building and access to an information highway.** WHYCOS provides the key element of an effective strategy for combatting the water crisis trough a two pronged fully integrated approach: **a global conceptual basis** providing a framework and general guidance which would be developed interactively and concurrently with the implementation of national, sub-regional, regional and basin-wide **operational components (HYCOSs)**, like the above-mentioned MED-HYCOS or SADC-HYCOS currently under development by WMO with the eleven countries of the Southern Africa Development Community (SADC), with the support of the European Union.

As stated by the WHYCOS Concept Panel meeting convened by WMO (6-8 February 1995, Geneva) WHYCOS should be **flexible and adaptable** enough to take into account the different current situations and their possible evolution. Therefore, it might be considered as one of the possible tools for improved integrated water management in the ESCWA region.

REFERENCES

Dooge, J.C.I., Goodman, G.T., La Rivière, J.W.M., Marton-Lefèvre, J., O'Riordan, T.O., and Praderie, F. (Eds) 1992. An Agenda of Science for Environment and Development into the 21st Century, C.U.P. 331p.

ICWE, 1992. The Dublin Statement and Report of the Conference, International Conference on Water and the Environment, 56p.

IUCN, 1991. Caring for the Earth. A strategy for Sustainable Living. IUCN/UNEP/WWF. 228p.

WMO/UNESCO, 1991. Report on Water Resources Assessment. Progress in the Implementation of the Mar del Plata Action Plan and a Strategy for the 1990s. 78p.

John C. Rodda, Serge A. Pieyns, Naginder S. Sehmi (WMO) and Geoffrey Matthews (World Bank), 1993. Towards a World Hydrological Cycle Observing System. Hydrological Sciences Journal, October 1993. p 373 to 378.

The World Bank, 1994. A guide to the Formulation of Water Resources Strategy. World Bank Technical Paper Number 263, 102p.

The World Bank, WMO, 1995. Final Report of the MED-HYCOS Scientific and Technical Meeting (Montpellier 17-19 May 1995). 16p.

TABLE 1

WHYCOS

DATA TO BE ACQUIRED AND TRANSMITTED

Environmental variable	Frequency of measurement per day
1. Water level	1 to 6 (depending on size of river
2. Water pH	1
3. Water conductivity	1
4. Water temperature	1
5. Dissolved oxygen	1
6. Turbidity	1
7. Air temperature	8 (synoptic hours)
8. Rainfall	24, plus daily total
9. Relative humidity	8
10. Windspeed	8
11. Net radiation	8

Housekeeping variable	Frequency of measurement per day
battery voltage	once per day
solar panel voltage	once per day
memory status	once per day
temperature inside instrument housing	once per day