

WORLD METEOROLOGICAL ORGANIZATION



**WHYCOS INTERNATIONAL ADVISORY GROUP
Second meeting**

**Geneva, Switzerland
31 May - 2 June 1999**

REPORT

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1. Opening of the meeting (agenda item 1)

1.1 The WHYCOS International Advisory Group held its second meeting from 31 May to 2 June 1999 in the WMO Headquarters in Geneva. The participants are listed in **Annex 1** to this report.

1.2 Mr K. Hofius, president of CHy, chaired the meeting. He extended a warm welcome to the participants. He noted that the participants included the Regional Hydrological Advisers from RAI, RAV and RAVI to whom he extended a special word of welcome.

1.3 The Deputy Secretary-General of WMO, Mr M. Jarraud, welcomed the participants on behalf of the Secretary-General. He recalled that this meeting was being held immediately after Thirteenth WMO Congress and the fifty-first session of the Executive Council which had taken some decisions concerning WHYCOS. In particular, mention was made of the resolution which was adopted on the exchange of hydrological data and products. This resolution now provides the internationally agreed framework on the subject, and Members are urged to implement it. He highlighted both the regional and global dimension of the WHYCOS programme, the later being essential for large-scale applications.

1.4 In response to a question from Mr P. Mosley concerning the level of commitment of WMO to WHYCOS, Mr Jarraud pointed out that this was fully reflected in the continued support of Congress and that allocation of specific resources to the programme was a matter for further discussion in the Executive Council.

1.5 Mr A. Askew, Director of the Hydrology and Water Resources Department, also extended a welcome to the participants.

2. Approval of the agenda and organization of the work (agenda item 2)

2.1 The meeting adopted the agenda, as given in **Annex 2**. It also agreed on the organization of the work of the meeting.

3. Consideration of the report of the first meeting of the WIAG (June 1998)

3.1 The Group considered the report of its last meeting, which contained a number of recommendations for action. This referred in particular to the following:

- (a) *Objectives for WHYCOS*: These had been approved by the Secretary-General
- (b) *Revised terms of reference and the composition of WIAG*: These had been approved by the Secretary-General
- (c) *WHYCOS Office*: This is reported below, under agenda item 4;
- (d) *Data exchange and data sharing*: An agreement exists within MED-HYCOS
- (e) *Performance indicators*: This is reported below, under agenda item 7;
- (f) *Information infrastructure*: This is reported below, under agenda item 9;
- (g) *Financing, sustainability and global coverage*: The question of global coverage was addressed under the discussion on the global concept (agenda item 8).

- The WIAG agreed that the WHYCOS concept was good, its implementation was off to a good start but that the immediate issue to be addressed is how best to ensure the continuity of the existing projects. In this connection, the Group recognized the key role of the regional centres and the need to support their activities. Donor agencies were requested to consider longer-term support to projects by means of a phased action plan and supporting budget. The urgent need to bring in other donor agencies was recognized.
 - On the question of financing future projects, consideration was given to the pooling of financial support. In this connection, it was noted that donor agencies have different policies and emphasis should therefore be placed on co-ordinating efforts to better serve the development of the programme.
 - The meeting agreed that marketing and communication should be improved, notably toward users. Increasing the participation of users may reduce the need for donors and ensure sustainability of the programme in the long run. Further, it was felt that communication should not be restricted to the hydrological community. International fora should be used to demonstrate WHYCOS and disseminate its message. The meeting noted the key role of senior water professionals and elected representatives in placing water high on national development agendas, and therefore recommended that, as a priority, the marketing and communication strategies should be tailored to reach decision-makers.
 - Donor agencies when considering request for project funding should insist on the commitment to a data programme.
- (h) *WHYCOS contribution to global freshwater assessments:* Plans for future global freshwater assessments and related activities in support of CSD have not yet been established and so any contribution by WHYCOS would be a subject for future consideration. However, the discussion under agenda item 8 was of relevance to this general topic;
- (i) *Hyperlinks to the World Bank Internet based Water Resource and Comprehensive River Basin Management Training Programme:* This link has been established from the MED-HYCOS Web site;
- (j) *WHYCOS as a partner in the WWC/Dutch "Vision" initiative:* The "Vision" process invited contributions from any interested parties. There was some concern that water resources assessment and information systems in the water sector might not be adequately covered. Therefore, while it was not considered appropriate to submit information on WHYCOS as such, the Group developed a brief text on information systems in general as an input to the "Vision". This text is attached as **Annex 3** to this report.
- (k) *WHYCOS as a partner in the Encyclopedia Of Life Support Systems (EOLSS) initiative:* Given the present status of development of this initiative, the Group felt that for the time being there was no need for any further action.
- (l) *Paper to be submitted to the conference in the Netherlands in September 1998:* This paper was presented.
- (m) *Involvement of the private sector:* This recommendation is being taken into account in the formulation of HYCOS project documents such as IGAD-HYCOS and the Regional Hydrological Meteorological and Climatological Information System (Congo-HYCOS).

The WIAG made the following recommendations:

3.2 **Recommendation by WIAG:** *The WMO Secretariat should develop marketing and communication strategies to be used by all involved in demonstrating the value of WHYCOS products.*

3.3 **Recommendation by WIAG:** *If possible, a presentation on WHYCOS should be made at the Second World Water Forum, to be held in The Netherlands in March 2000.*

3.4 **Recommendation by WIAG:** *The WMO Secretariat to submit the text in **Annex 3** to the Vision Management Unit for its use and follow-up, as appropriate.*

3.5 **Recommendation by WIAG:** *The WMO Secretariat to develop a companion text on the means to achieve this vision, based on inputs from WIAG, and submit it to those within the Global Water Partnership who are responsible for developing the Framework for Action.*

4. Consideration of the draft report of the last WCG meeting (April 1999)

4.1 Mr Askew noted that the report of the WCG meeting was still a draft. This report referred to two actions which WIAG might take, namely:

- *Reporting mechanism:* the WIAG was invited to consider its reporting mechanism. It noted that the Group had been established by the Secretary-General and consequently should report to him through its chairman. It noted also that there were several levels of reporting, with the various members of WIAG also reporting each to his individual constituency.
- *Global strategy and development of new HYCOS components:* This is reported below, under agenda item 8;
- *WHYCOS Office:* The meeting noted that the proposal for the establishment of a WHYCOS Office had again been considered by the second WCG meeting. The value of establishing such an Office had been appreciated and it had been recommended by the WCG that the Director of the HWR Department should seek the approval of the Secretary-General for the creation of such an Office and discuss with him the modalities for its establishment. This proposal would be submitted to the Secretary-General in the near future.

4.2 **Recommendation by WIAG:** *That WMO Secretariat report on WHYCOS also to the external community using all available means, such as the IAHS Newsletter, presentations to conferences and meetings (especially those outside the hydrological community).*

5. Results of Cg - XIII and EC - LI (agenda item 5)

5.1 The meeting was advised of the principal results of the recent sessions of the WMO Congress and the Executive Council as regards the HWR Programme. Reference was made in particular to the views of Congress concerning WHYCOS, including the keeping in force of Resolution 20 (Cg-XII), and the adoption of a resolution on the exchange of hydrological data and products (Resolution 25 (Cg-XIII)).

5.2 **Recommendation by WIAG:** *The coordinators of the MED-HYCOS and SADC-HYCOS projects to consider the application of Resolution 25 (Cg-XIII) to their respective projects and to advise what data might be exchanged without conditions and what might be made available under certain conditions. It was agreed that this subject would be discussed at the next meeting*

6. Current status of implementation and development of HYCOSs (agenda item 6)

MED-HYCOS

6.1 Mr Marc Morell, coordinator of the MED-HYCOS PRC made a presentation highlighting the achievements of the project and the constraints which are faced.

6.2 Twenty-five countries in the Mediterranean Basin are participating in the project. The first phase of the project, which will run until 31 December 1999, is being executed with the support of a US\$ 1.7 million grant from the World Bank. The project is being implemented to fulfil the five immediate objectives of the project agreed upon by the countries in June 1995:

- Objective 1: Implementation of a Data Collecting Platform (DCP) network for the collection in real time of several variables related to water quantity and quality and to meteorology.
- Objective 2: Development and implementation of a MED-HYCOS Information System including information related the project and its partners, a regional data base and tools to collect, process and exchange data on water resources.
- Objective 3: Improvement of national Hydrological Services notably through provision of new equipment and development of related training programmes.
- Objective 4: Creation of an information infrastructure to provide linkages between the MED-HYCOS project and other development initiatives within the region.
- Objective 5: Implementation of a regional computer network for the monitoring of the regional water resources.

6.3 The meeting was informed that negotiations were underway with the European Commission to mobilise resources to support MED-HYCOS Phase II, in which more emphasis will be given to water quality.

6.4 The main achievements were summarized as follows:

- the installation of a DCP network of 12 stations; 15 to 20 others are expected to be installed by the end of 1999;
- the implementation of an efficient and user-friendly Hydrological Information System with data (real-time, near real-time and historical) supplied by 17 countries; and
- the establishment of strong co-operation among more than 20 National Hydrological Services around the Mediterranean and Black Seas.

6.5 It was noted that one of the main results of the project was the awareness of both the benefits of new technologies to increase the capacities of National Hydrological Services and the necessity to improve, not only the exchange of data among them, but also the supply of these data to the international community.

6.6 One of the main constraints observed during Phase I was the delay in getting the DCPs operational, due to administrative and technical problems at the level of the different partners involved.

6.7 The group expressed its appreciation to Mr Morell and his colleagues and to IRD (formerly ORSTOM) for the tremendous work put into the development of the first operational system based on the WHYCOS concept. It was recognized that in many respects MED-HYCOS was acting as a pilot project and that the experience gained in its implementation was proving of great benefit to ongoing HYCOSs and those being planned.

SADC-HYCOS

6.8 Mr Stéfán van Biljon, SADC-HYCOS PRC coordinator, presented the main achievements of the project according to the performance indicators established for its implementation:

- Installation of DCPs: 16 DCPs installed in 7 countries, no installations in Angola, Mozambique and Zambia as yet.
- Database development and implementation: Windows version of HYDATA being debugged, not operational as yet.
- PRC developed an interim database to capture incoming data: Use to commence on 31 May 1999.
- Training: Two ten-day courses were conducted during the period June/August 1998 on DCP installation and maintenance and on HYDATA operation and maintenance. In addition, technology transfer takes place during visits to countries for DCP installation.
- Data collection and transmission efficiency: Raw data captured satisfactorily from field installations by the PRC. Some data loss experienced due to vandalism. Distribution of data in the region dependant on progress with the installation of the relevant equipment.
- Quality and timeliness of data: Little progress. National and regional databases to be implemented and communication network to be established.
- Regional co-operation and collaboration for the assessment, monitoring and management of shared water resources: Flood warnings have been issued. Communication network in need of enhancement.

6.9 The excellent level of cooperation between all the partners of the project was highlighted, as well as the fact that some countries demonstrated their ability to install DCPs without external support, only requiring assistance from the PRC to check electrical connections before switching them on.

6.10 Some general comments were raised on the importance of preparing civil works prior to DCP installation. It was noted that vandalism was a problem in the sub-region and that Zimbabwe had appointed local "observers" recruited from the nearby communities, with good effect. Mention was also made of other points, as follows:

- trained and experienced staff often get transferred easily in the region, thus creating a problem of sustainability and continuity (training becomes a never-ending task);
- some Hydrological Services in the region have limited office equipment and transport is problematical since very few vehicles are assigned to the Services;
- a lot of emphasis is placed on instilling the idea of ownership of the project. Staff in the SADC region are very keen to make progress with the project;
- The PRC and participating countries do not see the main emphasis of the future of the project to be the installation of another 50 DCPs, but rather a consolidation of the project in terms of monitoring, validation and archiving of data. The development of enhanced hydrological products based on the latest data captured and the extension of hydrological time series should also be given priority. Participating countries at the SADC Water Resources Technical Committee meeting, held in Luanda, Angola in May 1999, supported this view.

6.11 On the basis of his experience, Mr van Biljon recommended that, wherever possible:

- 1) the sites for installing DCPs (or any other equipment required) should be decided on at an early stage, preferably at the time when the project document is drawn up.

- 2) pre-installation site inspections should be undertaken to determine the exact needs for equipment and civil works.

Other HYCOS components

6.12 The meeting was informed by the Secretariat of the status of development of other HYCOS components. The following was noted:

- *AOC-HYCOS (West and Central Africa):* A project document has been prepared and circulated to 23 countries of the sub-region and to the French Co-operation. Nine countries have so far confirmed their interest in participating in the project. Negotiations are underway with the French Co-operation to fund a pilot phase of the project involving these nine countries and a request is being considered by the French Fund for Global Environment. The primary aim of this pilot phase, which is expected to start in 1999 and last 18 months, is to secure what is already existing in terms of a regional information system, notably the Regional Hydrological Observatory for West and Central Africa developed by IRD in Ouagadougou, and to transfer it as soon as possible to a PRC hosted by a national or regional organization to be selected and agreed upon by the parties concerned. Burkina Faso, Guinea, the Niger Basin Authority (NBA), and AGRHYMET have all offered to host the Pilot Regional Centre. The Group was informed that there were plans under a Dutch funded project to install 16 DCPs in Guinea and Mali and that discussions were underway with the relevant authorities with a view to incorporating these stations into the AOC-HYCOS network.
- *RHMCIS - Regional Hydrological, Meteorological and Climatological Information System:* Within the framework of the Regional Environmental Information Management Programme (REIMP), supported by the World Bank and other organizations, the European Commission has funded (with a grant of ECU 126,800) the preparation of the project document for the RHMCIS. Congo-HYCOS represents the RHMCIS hydrological component. Congo-HYCOS will be implemented concurrently with the strengthening of the regional component of the WMO World Weather Watch (WWW) Observing Network and Reference Climatological Stations.

A start-up meeting, attended by representatives of national Hydrological and Meteorological Services and WMO Secretariat was held in September 1997, in Libreville, Gabon to provide inputs to the project preparation. The draft project document, based on national reports and on country visits, was sent in February 1999 for comments to the European Commission, General Directorate VIII - Development, and the participating countries.

The meeting appreciated the development of projects of this nature which will promote closer co-operation between the hydrological, meteorological and climatological communities.

- *CARIB-HYCOS:* The development of this project for the countries of the Caribbean Basin was supported by most of the countries participating in the Conference on Water Resources in Latin America and the Caribbean (San José, Costa Rica, 1996) and by XII-RA IV (May 1997). Two missions were fielded, in July and October 1998, to eight selected Central American and Caribbean countries to assess the needs for the preparation of the project document. The mission reports have been reviewed, homogenized and edited. A section on the financial aspects has been added by the WMO Secretariat and the document will be circulated for comments to the countries concerned. Plans are being developed for the organization of a start-up meeting in 1999.

The UN Commission on Sustainable Development (CSD), when considering the problems of Small Island Developing States at its sixth meeting, recognized the importance of the WHYCOS programme. It noted in particular the value of the Carib-HYCOS component in contributing to the assessment and sustainable management of water resources and to flood warning. The Inter-American Development Bank has expressed interest in funding the pre-feasibility study. Carib-HYCOS would contribute to a better knowledge and understanding of the impact of El Niño on the water resources of the region.

- *IGAD-HYCOS*: This has been included as priority project by the IGAD Secretariat for support by the European Commission. The project document is being prepared with the financial support (EU 85,000) from the Commission.

National experts were designated by the six participating countries to prepare national reports on the status, perspectives and requirements of hydrological activities in their countries. A Joint WMO/IGAD mission visited the countries in early 1999 to identify needs for a draft project document, with the support of national experts. The project document is being finalized for circulation to the parties concerned.

- *Baltic-HYCOS*: A meeting to discuss the actions to be taken for the development of the project proposal was held in September 1998 in the SMHI Headquarters in Norrköping (Sweden) with the participation of the representatives of twelve countries of the region.

Estonia, Finland and Germany have volunteered to cooperate with the WMO Secretariat in the preparation of the project document which is expected to be ready by July 1999. A second meeting of the country representatives is tentatively planned for October/November 1999.

Baltic-HYCOS was seen as an example of a project being developed mainly on the basis of national expertise and co-operation among the participating countries.

- *Black Sea-HYCOS*: A meeting of representatives of the Permanent International Secretariat (PERMIS) of the Black Sea Economic Commission (BSEC) and WMO was organized in Istanbul in September 1998. Following requests received from the countries and BSEC PERMIS, three national experts from Romania, Turkey and Ukraine will assist the WMO Secretariat in the preparation of a project profile to be submitted to a start-up meeting planned for late 1999 in BSEC PERMIS.

6.13 The Group noted that a number of other HYCOS proposals are under consideration but that little had been achieved due to the limited resources of the Secretariat. These proposals include projects for the Nile, Danube, Arctic, Southwest Pacific, Amazon, La Plata and Andes regions and the Aral and Caspian Sea basins.

6.14 Following the presentations there was a general discussion and the following were noted:

- Security problem in some countries can delay the implementation of some projects;
- Linking various projects was an option so as to present a package to donors;
- Sustainability should not be based on grants, participating countries should feel ownership of HYCOS components;
- Groundwater monitoring might be included in HYCOS projects, but cheaper non-real time methods were available for this purpose.

7. Performance indicators

7.1 The Group discussed this item on the basis of a document prepared by the Secretariat. The document presented performance indicators against the WHYCOS objectives as adopted at the first WIAG meeting. For each objective, two categories of indicators are proposed: Objectively Verifiable Indicators (OVI) and Subjectively Verifiable Indicators (SVI).

7.2 The Group agreed on the set of performance indicators for the WHYCOS programme as given in **Annex 4**.

7.3 **Recommendation by WIAG:** *The set of performance indicators given in Annex 4 should be used by the WHYCOS Programme. Individual HYCOSs will need to collect the relevant data for aggregation.*

7.4 **Recommendation by WIAG:** *Examples of indicators currently used for measuring achievements in the implementation of HYCOS components are included in Annex 5. However, the Group recognized that each HYCOS project should establish its own set of indicators according to its specific objectives.*

8. WHYCOS - The global concept

8.1 The discussion on this item was based on a paper prepared by Mr P. Mosley. Consideration was also given to views expressed in the discussion of WHYCOS at Cg-XIII. The Group noted that the global concept and the objectives of the programme, as agreed by its first meeting, were fully reflected in the WHYCOS brochure (WMO-No 876). The Group recognized that the global concept was the initial inspiration for WHYCOS and remained a leading force, but emphasized that a bottom-up approach, as currently adopted, was essential so as to ensure the involvement of the countries concerned and respond to their needs.

8.2 The Group appreciated that the global concept was driven by scientific needs and by the need of governments and intergovernmental bodies for advice on the state of the World's water resource. However, the regional developments were driven by the priorities of the countries for socio-economic development.

8.3 WIAG took particular note of the proposal of Cg-XIII that it develop further the global concept of WHYCOS so that, amongst other aims, links be established with other global activities.

8.4 **Recommendation by WIAG:** *In view of the discussion recorded under 8.1 and 8.2 above, the advice of international experts should be engaged first to study the relevant international activities and identify their needs for hydrological data. The results of this study could then be used to help plan a number of future programmes, including those of GRDC and WHYCOS, as well as the G3OS.*

8.5 **Recommendation by WIAG:** *The following actions should be taken so as to ensure that both national/regional and global benefits are derived from the regional HYCOSs:*

- *Project documents for future HYCOS initiatives should specify that the standards of practice and data quality that are defined in the WMO Technical Regulations and Guide to Hydrological Practices shall be adopted, with emphasis given to data quality assurance.*

- *The WIAG and WCG should ensure that G3OS, WCRP and other scientific interests are aware of all HYCOS proposals and that, to the extent possible, their requirements are taken into account when designing HYCOS networks. This will require that their interests have specified their requirements for hydrological observations.*
- *All intending participants in HYCOS should be requested to agree to and implement the conditions relating to the exchange of hydrological data that are established in Resolution 25 (Cg-XIII)*
- *Individual HYCOS project coordinators should make contact and seek collaboration with corresponding FRIEND groups and other relevant programmes.*

9. WHYCOS with regard to information infrastructure

9.1 The discussion on this item was based on a paper presented by the Secretariat which took into account the proposals of the World Bank representative at the first WIAG meeting. The focus was largely on the transfer of information using modern technology such as the Internet. It was recognized that this information infrastructure is not merely linking up Web sites of the various HYCOSs but required inputs from information scientists, in particular for the definition of information products based on user needs. In view of the experience gained with MED-HYCOS, Mr M. Morell was requested to prepare a draft proposal as to the requirements of an information system (for both HYCOS and WHYCOS) and to prepare terms of reference for a consultant to carry out this work. Members of the WIAG were requested to provide Mr Morell with inputs for the preparation of the terms of reference for this task. This subject will be discussed further at the next meeting.

9.2 The meeting recognized that an efficient information system is the core of WHYCOS and should ensure its sustainability. It noted that there are a number of other water-related global initiatives to develop information systems and felt that WHYCOS should collaborate with these initiatives to the extent possible. Particular mention was made of relevant initiatives by the GWP and WWC. The meeting appreciated that, at this point in time, there was no great urgency for a WHYCOS information system, but that its development was necessary so as to point the way forward.

9.3 ***Recommendation by WIAG:*** *Define the requirements of an information system for HYCOS and WHYCOS and prepare terms of reference for a consultant to develop such a system.*

10. Future meetings

10.1 The WIAG agreed that the discussions at these meetings are valuable and should be continued once a year. It proposed that the next meeting should be held during April - May 2000.

11. Any other business

11.1 Under this item the meeting discussed ways of creating more awareness of WHYCOS and recalled that the need for marketing WHYCOS was recognized by WIAG I (Rec. 6.15). It noted that other programmes were using television channels such as CNN for the promotion of their activities.

11.2 ***Recommendation by WIAG:*** *Secretariat should investigate the possibility of obtaining free publicity slots on communication media such as CNN and French TV such as TV5 also discuss with the TVE the possibilities of production and distribution of short items on data funding crisis.*

12. Approval of the report of the meeting

12.1 The WIAG approved the report of the second meeting and requested the Secretariat to make any editorial changes deemed necessary.

13. Closure of the meeting

13.1 The meeting closed at 16h30 on Wednesday 2 June 1999.

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AGENDA

1. OPENING OF THE MEETING
2. APPROVAL OF THE AGENDA AND ORGANIZATION OF THE WORK
3. CONSIDERATION OF THE REPORT OF THE FIRST MEETING OF THE WHYCOS INTERNATIONAL COORDINATION GROUP (JUNE 1998)
4. CONSIDERATION OF THE DRAFT REPORT OF THE LAST WCG MEETING (APRIL 1999)
5. RESULTS OF CG-XIII AND EX-LI
6. CURRENT STATUS OF IMPLEMENTATION AND DEVELOPMENT OF HYCOSs
 - 6.1 AOC-, Baltic-, Black Sea-, Carib-, Congo- and IGAD-HYCOS, by the Secretariat
 - 6.2 MED-HYCOS by M. Morell, PRC Coordinator
 - 6.3 SADC-HYCOS by S. van Biljon, PRC Coordinator
7. CONSIDERATION OF A DRAFT SET OF PERFORMANCE INDICATORS
8. WHYCOS - THE GLOBAL CONCEPT
9. WHYCOS WITH REGARD TO INFORMATION INFRASTRUCTURE
10. FUTURE MEETINGS OF WIAG
11. ANY OTHER BUSINESS
12. APPROVAL OF THE REPORT OF THE MEETING
13. CLOSURE

Water resources information – a vision for 2025

Information and Communications Technology (ICT) in 2025 will offer virtually unlimited possibilities for the management of information about water resources. The global community will have recognised the vital need for sound data and information as a basis for sustainable resource management, and will be working hard to enable all its members to benefit fully from ICT. The principal restrictions that remain will be caused by institutional limitations and a lack of trained staff. Staff training using distance education, enlightened approaches to the transfer of knowledge and technology, and assistance with institutional development are some of the ways in which remaining barriers to the fullest possible use of technology are being removed.

Modern ICT will be in use in every country, with water information systems that are designed for use there. They will be suited to the particular circumstances found in each country, and in particular will be relevant to its social, economic and environmental aspirations. Information about water resources will address a wide spectrum of topics, from groundwater availability through to indicators of water quality or the health of wetland ecosystems, and including measurements of demand and use, supply and replenishment. Water information will be integrated fully with that on other relevant aspects of the environment, society, and the economy. The information systems will be delivering information to all the potential users – officials, elected representatives, members of the public, vulnerable communities, educational institutions, and so on. The users will receive information when and where they need it, and in forms in which they can best make use of it – without information overload. Accordingly, they will be able to make decisions swiftly and respond with confidence, while minimising the risks and costs of poor decisions.

Comprehensive systems for managing water-related information will integrate many ICT components, from real-time transmission of observations, through high-capacity computers for data archiving and analysis, to sophisticated decision support systems. Decision support will be available not just to water professionals, but to anyone with a computer linked to the system, and will facilitate a high level of interaction and feedback. As a result, “stakeholder participation” in decision making will have become an effective reality. The greatest limitation on comprehensive systems for managing and using water information still will be the availability of basic, quality-assured observations, carried out over long periods of time. Observations on-site are costly and, even when they use automated sensors, demand a considerable input of skilled human labour, for calibration, quality control, and maintenance. Nevertheless, the use of robust field sensors and telemetric data transmission, as well as remote sensing of hydrological conditions over a large area by satellite, will be supplying increasing volumes of high quality digital data. These will be input directly into the information systems, enabling information about current conditions, as well as forecasts, to be available in near-real time to resource managers.

National and regional information systems will be inter-linked, so that, in effect, a world-wide information base enables a hitherto unmatched ability to understand the global climate system and water cycle. This in turn will enable medium to long term (weeks to months) forecasts of extreme weather conditions – particularly droughts and seasons of above average precipitation or storminess – with levels of confidence approaching those presently achieved for short range (2-3 day) weather forecasts. Real-time transmission of water and weather information, in conjunction with highly developed computer models of weather systems and river catchments, similarly will provide quantitative forecasts of precipitation, floods and low flows whose accuracy allows mitigatory measures to be taken with confidence. These forecasts will be on time scales ranging from 2-3 hours (for forecasting flash floods in the steep rivers of small tropical islands, for instance) through to 1-2 months (needed for water management in large continental rivers).

Performance indicators related to WHYCOS Objectives in the operational phase

WHYCOS Objectives	OVI	SVI
<ul style="list-style-type: none"> To work towards a global water observation and information system 	Number of participating countries	Improvement in political and scientific recognition
<ul style="list-style-type: none"> To strengthen the technical and institutional capabilities of national Hydrological and Hydrometeorological Services through training and capacity building 	Number of NHSs involved Number of people trained under WHYCOS development	Improvement attributable to WHYCOS in the level of recognition of NHSs in terms of budget and mandate Involvement of national experts at regional and international levels
<ul style="list-style-type: none"> To develop and enhance information systems (IS) for providing reliable water-related data, information and products to meet users' needs (for example, flood forecasting and warning, drought forecasting and water resources management) 	Number of national and regional ISs developed/improved Total station-years of data held that meet required quality standards Number of information requests fulfilled, by types of use	Improvement in the mitigation/alleviation of water related hazards and in WRM
<ul style="list-style-type: none"> To establish a global network of key national observing stations for providing consistent, high-quality data on water quantity, water quality and weather, transmitted in real-time to national and regional data centres 	Total number of WHYCOS stations Number of stations whose data are available online with no restrictions (and as a percentage of total) Number of stations that are fully functional (and as a percentage of total) Station-years of data received during the last year, by types of data (and as a percentage of total possible) Percentage of the data received that meet required quality standards and have been archived within required time	Improvement of data sharing culture

Table continued

<ul style="list-style-type: none"> ▪ To promote and facilitate the dissemination and use of water-related information through up-to-date technology 	<p>Number of Web sites from which data and information can be accessed Number of station-years of data available via Internet (and as a percentage of total number) Number of unassisted online database queries (and as a percentage of total number) Number of station-years of data available on CD-ROM (and as a percentage of total number) Number of CD-ROMs distributed to users</p>	<p>Improvement in the range of data analysis tools available to Internet users Improvement in the types of information (analysed data) available to Internet users Establishment of data policies and development of Information Technology</p>
<ul style="list-style-type: none"> • To stimulate water resources assessment activities 	<p>Number of surveys conducted of national capabilities in WRA Number of countries which have programmes to enhance their national capabilities in WRA Number of WRA projects conducted</p>	<p>Improvement in water resources knowledge Improvement in the application of water resources knowledge to national and regional development Improvement in Planning, Development, Allocation and Management of water resources</p>
<ul style="list-style-type: none"> ▪ To strengthen co-operation at the basin, regional and international levels as a contribution to integrated water resources management 		<p>Improvement of relationships among users of the same water resources</p>
<ul style="list-style-type: none"> • To enable the availability and use of water-related information for larger scale applications in other WMO and international scientific programmes 	<p>Number of projects and programmes which are using WHYCOS-sourced data Number of station-years of WHYCOS-sourced data accessed by international scientific programmes Financial support from other projects and programmes Number of data sets from other global programmes that WHYCOS is able to access</p>	<p>Improvement of knowledge and related progress in socio-economic development Enhanced database for research and development of hydrological products</p>
<ul style="list-style-type: none"> • To establish a framework of guidelines and compatible standards for data collection, storage, dissemination and exchange 	<p>Number of NHSS that have established/adopted guidelines and standards for data collection etc.</p>	<p>Improvement in use of existing standards and technical regulations</p>

Example of sets of indicators currently used during the implementation of various HYCOS projects

- Four overall indicators relating to :
 - Installation of DCPs;
 - Database development;
 - Training activities; and
 - Product development.
- Efficiency of the data collection and transmission system based on the quantity of raw data captured and stored in the national and regional electronic archives;
- Quality and timeliness of the primary and secondary data saved both in national and regional data bases;
- Level of recognition of the value of the products prepared by the PRC and the participating countries at national, regional and international levels;
- Initiatives taken by SADC to make use of SADC-HYCOS as a tool for the regional co-operation and collaboration for the assessment, monitoring and management of shared water resources.
- Ability of the participating countries to create the necessary conditions for transferring the Observatoire Hydrologique Régional pour l'Afrique de l'Ouest et Centrale (OHRAOC) to the PRC, at the latest on **31 January 2000** (formal agreement on PRC host institution; personnel to be recruited, work plan and time schedule for the implementation, etc.);
- Ability of the PRC host institution to ensure, with the financial support of the project and technical assistance of IRD(formerly ORSTOM), which should last until 30 June 2000, the operation of the OHRAOC and the dissemination of information (preservation or increase of the number of stations included, updating of the database and Web site, etc.);
- Extent to which the countries are valorising the support given by the project;
- Number and categories of training organized and nature of the audience;
- Number and categories of stations improved;
- Efficiency of the data collection and transmission system (number of rough data collected and archived at national and PRC levels);
- Number of Internet connections installed in participating countries and rate of use;
- Number of Web sites open in the participating countries and number of hits;
- Number and categories of information documents prepared and disseminated, public targeted and effectively reached;

- Impact at national, regional and international levels of the hydrological products prepared by the PRC and the NHS;
- Quality, accessibility and updating of national and regional databases;
- Interest shown by the scientific community, the media and the donors;
- Initiatives taken by decision-makers and other users to utilize the hydrological information system implemented by the project as a tool for regional cooperation for assessing, monitoring and managing the shared water resources;
- Level of funding commitments generated by the pilot phase on the basis of the requests from the countries to the donors agencies.