



THE MEDITERRANEAN HYDROLOGICAL CYCLE OBSERVING SYSTEM

MED-HYCOS Phase 2, period 2002-2005

Project Proposal

Montpellier, June 1, 2001

REPORT n° 17

MED-HYCOS PRC

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1. Introduction

MED-HYCOS Project (Mediterranean Hydrological Cycle Observing System) is one of the regional components of the global programme WHYCOS (World Hydrological Cycle Observing System), launched by the World Meteorological Organisation (WMO). The first phase of MED-HYCOS (1995-2000) was supported by the World Bank with a grant of US \$ 1,700,000 and co-ordinated by a Pilot Regional Centre hosted by Institute of Research for Development (IRD, formerly ORSTOM) in Montpellier (France).

The National Hydrological Services (NHSs) of twenty-four countries of the Mediterranean and Black Sea Region participated in the project implementation (see Annex 1). The first phase was focused on the development of a regional co-operation network promoting the exchange of hydrological data and information: a hydrometeorological data collection network has been established, a regional hydrological information system has been developed, based on a regional database and a web site, and training activities have been implemented.

The participating countries have expressed their interest in extending the project activities into a second phase, during which the technologies and tools developed at regional level would be transferred at national level, in order to reinforce NHSs capabilities, and the regional co-operation framework would be consolidated. The second phase will have emphasis on strengthening the regional approach to water related issues, in particular water assessment and management, use of real time data for flood forecasting and warning, use of Internet oriented products and tools, and associated training programmes. The main focus will be on the transfer at national level of the MED-HYCOS Data Management System tools and products developed at regional level, on strengthening the NHS capabilities to maintain, sustain and develop such information systems, as well as on improving and fostering co-operation among NHSs and with regional research projects and institutions.

2. Context

2.1 General considerations

To reconcile the need for good-quality freshwater for human uses with environmental protection is one of the greatest challenges humanity will be facing in the 21st century. The most obvious way to success is through improving water management. The Agenda 21 (UNCED, 1992) chapter 18 on freshwater and the report of the International Conference on Water and the Environment (ICWE, 1992) on which it was based, recognise that knowledge of the water cycle (quantity and quality) is the essential basis for efficient water management.

Water assessment and management is indeed dependant on the existence and availability of reliable water resources information both at national and regional levels, covering not only the collection and analysis of data but also the exchange and dissemination of these data and related information and knowledge to the users, at all levels of decision making.

The lack of data or difficult access to data - prevalent today because of the failure to collect it or the failure to share it - seriously hinders proper planning and management of water systems. In many areas of the world, particularly those with extreme water-scarcity, the development process itself depends on the ability of water managers and planners to provide or receive adequate data and information at the right time. Modernizing Hydrological Services to enable them to provide the required data and information will require blending and reinforcing conventional information systems with modern technology and equipment, as well as collecting new information related to the ecological, social, cultural and institutional aspects of sustainable water management and use.

However, Chapter 18 of Agenda 21, the ICWE report, the WMO/UNESCO report on water resources assessment (1991), the Comprehensive Assessment of the Freshwater Resources of the World (1998) , as well as a number of recent international Conferences, such as the Paris Conference (March 1998) stress that, in many regions of the world, these information systems are not functioning adequately or do not exist at all.

Main reasons for that situation are:

- (i) inadequate funding by the Governments as a result of economic difficulties in many countries and especially in the developing ones;
- (ii) little awareness of politicians, decision makers and public at large of the central role of water-related information and knowledge for sustainable socio-economic development;
- (iii) difficulties for many national services/agencies to move from their historical data collection-oriented role to user-oriented information and knowledge management;
- (iv) world-wide trends toward reduction of the public sector involvement;
- (v) limited interest of the private sector to invest in the long-term operation and maintenance of networks of observing stations. This is the most expensive part of an information system, but also the one without which information and knowledge cannot be generated and made available; and

- (vi) response and not prevention based approach to water related disasters in many governmental policies.

The nineteenth Special Session of the UN General Assembly called for highest priority to be given to the serious fresh-water problems facing many regions and pointed out that there is an urgent need:

- (i) to formulate and implement policies and programmes for integrated watershed management, including notably issues related to pollution and waste, the interrelationship between water and land, estuarine environment, coastal zones, biodiversity and the preservation of aquatic ecosystems, etc. ;
- (ii) to strengthen regional and international co-operation for technology transfer and the financing of integrated water resources programs and projects; and
- (iii) to strengthen the capability of Governments and international institutions to collect and manage information, including scientific, social and environmental data.

Accordingly, the report of the Sixth Session of the Commission on Sustainable Development (CSD), (1998), urges Governments to address the numerous gaps identified in the path towards integrated water resources development, management, protection and use notably by giving further attention to hydrology and to the capacity to assess the availability and variability of water resources. Moreover, CSD encourages Governments notably:

- (i) to establish and maintain effective information and monitoring networks and further promote the exchange and dissemination of information relevant for policy formulation, planning, investment and operational decisions ; and
- (ii) to facilitate the collection and dissemination of water data and documentation that enhances public awareness of important water-related issues, to improve the understanding of meteorology and processes related to water quantity and quality and the functioning of ecosystems.

CSD also called upon the international community, including the United Nations system to support national efforts in information and data collection and dissemination through co-ordinated and differentiated action.

The European Union made important contributions to the international debate for new initiatives and recently the European Commission developed Guidelines for water resources development co-operation centrepiece of which is "a strategic approach for the equitable, efficient and sustainable management of water resources". Further in the light of the 5th Framework programme emphasis has been placed on research activities that should contribute to a number of key policy and legislative actions of the European Union as well as providing objective and timely scientific information to EU Institutes and Member countries. Specifically, activities should contribute to the Commission's new Key Action on "Sustainable management and quality of water" within the 5th Framework Specific Program "Preserving the ecosystem" by identifying problems and making recommendations to the 6th Framework Program.

2.2 The Mediterranean Basin

The major features of the Mediterranean climate are a long but considerably dry summer and a mild and wet winter. Most of the annual precipitation (up to 75%) occurs during the winter season in the Southern part of the basin, while on the Northern part precipitation occurs also during autumn and spring. While the concentration of precipitation during the cooler months represents an advantage in terms of water resources availability, due to the reduced evaporation, the considerable inter-annual variability of precipitation is a major risk factor (dry years occur on the average every ten years), compelling for instance farmer to depend upon irrigation to a relatively large degree. The renewable resources amount in average to 823 km³/y. The spatial distribution of these resources is markedly uneven, with 72% concentrated in the Northern part of the basin, 23% in the Eastern part and only 5% in the Southern part.

The major users of water resources are primarily irrigated agriculture followed by urban supply. Furthermore the continuous development of tourism, attracting millions of people during summer dry months in water scarce areas, is posing a further stress on water resources.

Human activities have heavily impacted on water resources, disrupting natural regimes and affecting water quality. Uncontrolled urbanisation patterns have allowed the development of settlements in flood prone areas, overpumping of groundwater has created major salinization of coastal aquifers, etc.

At present, the ratio between water withdrawal and renewable resources is for many countries above 50%, reaching 90% in Egypt and Israel and 400% in Libya, where fossil non-renewable groundwater is extensively used. The total withdrawal amount to 299 km³/y, out of which 52% in the Northern part of the basin, 18% in the Eastern part and 30% in the Southern part. The unbalance between these figures and those above on the natural resources distribution clearly indicate that the countries of the southern rim of the Mediterranean as those where the problems of water availability and management are the most urgent. The forecasts about water demand (GWP, Water for the 21st Century, Mediterranean vision on water, population and the environment) indicate an increasing trend in water resources consumption, the withdrawal being expected to increase by 30% in 2010 and by 50 % in 2025 in the business-as-usual scenario.

2.3 WHYCOS concept

In this context of present and predicted water crisis, the World Meteorological Organisation launched in 1993 the World Hydrological Cycle Observing System (WHYCOS). The WHYCOS initiative is aimed at providing a scientific basis and a framework for co-operation in water resources monitoring, assessment and integrated water resources development and management at community, river basin, national, regional, continental and global levels. It will contribute to knowledge of hydrological processes in their interaction with climate and the environment, and will encourage intersectoral sharing of water resources data and information for development and natural capital management.

WHYCOS is being implemented through regional operational components (HYCOSs) tailored to respond to the priority established by the participating countries themselves. MED-HYCOS is being implemented in the Mediterranean Sea basin.

3. MED-HYCOS Project Background : Phase I

3.1 The achievements

MED-HYCOS is the first regional component of WHYCOS programme to be implemented. The World Bank financed the first phase (1995-2000) the MED-HYCOS project with a grant of US \$. 1.700.000 The National Hydrological Services of the participating countries have made available resources from their own budget to support some project activities such as the installation, operation and maintenance of the field equipment and data transfer to the regional database. The details of the first phase budget, including national contributions are given in Annex 2.

The 24 participating countries which participate in MED-HYCOS first phase were Albania, Algeria, Bosnia-Herzegovina, Bulgaria, Cyprus, Croatia, France, Georgia, Greece, Italy, Jordan, Lebanon, Former Yugoslav Republic (FYR) of Macedonia, Malta, Moldavia, Morocco, Palestinian territories, Romania, Slovenia, Spain, Tunisia, Turkey, Ukraine and Yugoslavia.

A Pilot Regional Centre (PRC) which co-ordinated the MED-HYCOS activities is hosted in Montpellier (France) by Institute of Research for Development (IRD, formerly ORSTOM) since 1995. The Pilot Regional Centre manages the activities under the guidance of the Initial Co-ordinating Group (ICG), established by the project. The membership of the group includes representatives of the following countries and organizations: Bulgaria, Cyprus, Spain, France, Italy, Malta, Romania, Slovenia and Tunisia, WMO, World Bank, IRD, Friend-Amhy, and MEDIAS-France.

The major achievements of the initial phase of the project MED-HYCOS (1995-2000) were concentrated in four areas:

- the development of the Mediterranean Hydrological Information System;
- the establishment of a network of hydrometeorological Data Collecting Platforms;
- the implementation of training events and expertise exchange between countries;
- the development of a co-operation infrastructure.

3.2 The Mediterranean Hydrological Information System (MHIS)

The Mediterranean Hydrological Information System provides information on water resources in Mediterranean area, information on the activities of the project and on the partner institutions, etc. The core of the MHIS is represented by the regional database of around one hundred hydrological stations and by the tools for data collection, organization, processing, edition and dissemination on Internet.

On the web site the following types of information are available:

Information on the project (project document, progress reports, ICG meeting reports, etc), on its status of implementation and on PRC staff, including seconded experts;

Information on the participating NHSs (national focal points, other staff involved in the project activities, descriptions of the NHS);

Information about water resources availability and policy in the countries;

Information on the stations forming the project network (location, channel characteristics, hydrological regime, length of the historical series, quality and quantity of the information available);

However the most important feature of the Web site is represented by the regional data bank and the related tools for data retrieval and display;

The regional data banks contains data from 94 stations, including 27 equipped with DCPs. Data from standard station are updated weekly or monthly, based on the information supplied by participating countries. Data from DCP are retrieved three-hourly from EUMETSAT Web site. Statistical data on the database content are summarized in the tables below:

Variable	Aggregation	Stations	Records	Average number of records
Air_Temperature	Hourly	23	207679	9029.5
Rainfall	Daily	17	57567	3386.2
Rainfall	Hourly	25	271224	10848.96
Rainfall	Monthly	15	4558	303.8
Streamflow_Discharge	Daily	58	464672	8011.5
Streamflow_Discharge	Hourly	10	84874	8487.4
Streamflow_Discharge	Monthly	46	17017	369.9
Streamflow_Discharge	Yearly	6	284	47.3
Water_Level	Daily	21	94505	4500.2
Water_Level	Hourly	25	210827	8433.08
Water_Temperature	Daily	6	12487	2081.1
Water_Temperature	Hourly	23	206297	8969.4

Variable	Aggr.	Station Name	NrRec	MinDate	MaxDate
Air_Temperature	Hourly	Panayia_Bridge	21301	25/06/1997	09/05/2000
Rainfall	Daily	El_Feija	32767	01/05/1888	03/06/1987
Rainfall	Hourly	Metkovic	25396	25/06/1997	24/10/2000
Rainfall	Monthly	S.Bras_de_Alportel	1125	01/01/1901	01/09/1998
Streamflow_Discharge	Daily	Beaucaire	29341	01/01/1920	30/04/2000
Streamflow_Discharge	Hourly	Kirishane	15887	06/06/1997	05/11/2000
Streamflow_Discharge	Monthly	Beaucaire	936	01/01/1920	01/12/1997
Streamflow_Discharge	Yearly	Zaragoza	80	01/01/1914	01/01/1996
Water_Level	Daily	Log_Cezsoski	13879	01/01/1961	31/12/1998
Water_Level	Hourly	Panayia_Bridge	20851	08/07/1997	09/05/2000
Water_Temperature	Daily	Log_Cezsoski	3591	01/01/1989	31/10/1998
Water_Temperature	Hourly	Panayia_Bridge	20380	08/08/1997	09/05/2000

Variable	Aggr.	Number of years
Air Temperature	Hourly	54
Rainfall	Daily	179
Rainfall	Hourly	56
Rainfall	Monthly	397
Streamflow Discharge	Daily	1319
Streamflow Discharge	Hourly	26
Streamflow Discharge	Monthly	1448
Streamflow Discharge	Yearly	284
Water Level	Daily	272
Water Level	Hourly	56
Water Temperature	Daily	38
Water Temperature	Hourly	54

Three applications have been developed for accessing the database:

MED-DAT allows tabular and graphic representation of data, overlapping of diagrams from different years or different stations, automated routine download process of data from EUMETSAT

MED-MAP allows access to data through a cartographic interface, providing basic GIS facilities

MED-CLIM allows a real analysis and cartographic representation of climatological series.

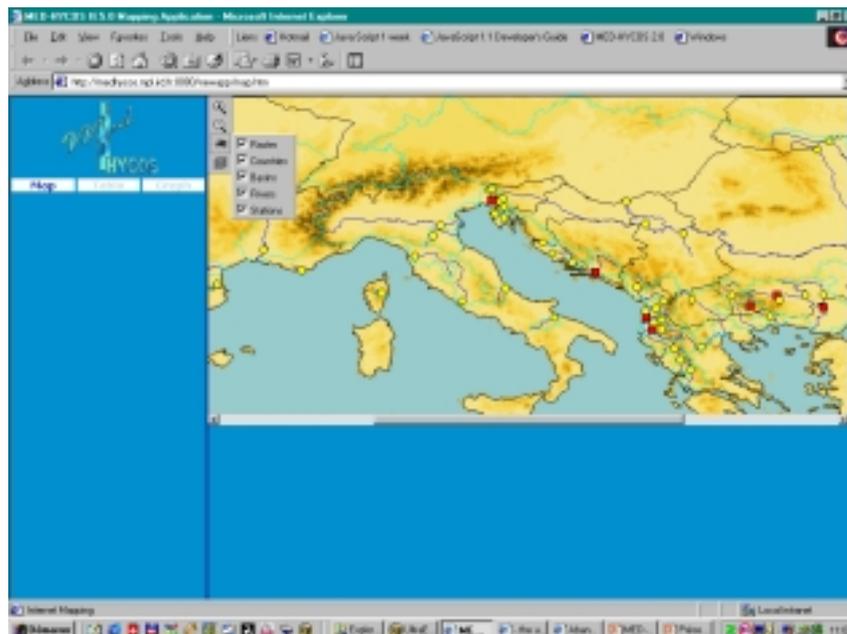
An exhaustive description of these tools is provided in Annex 3

The major feature of these tools is the possibility of accessing not only the Regional Database but any other Hydrometeorological Databases, such for instance National Databases provided that they are formatted according the same standards. They can work on local databases (hard disk, CD-ROM) and on remote databases accessed via Internet.

These tools have been developed by the PRC with the support of experts seconded from the participating countries.

The MHIS is accessible via Internet at the URL <http://www.medhycos.com>

A CD-ROM providing a copy of the MED-HYCOS Web site, the regional hydrometeorological database and the tools allowing the data consultation and processing is regularly distributed free of charge to all participating NHS and other stakeholders.



**Cartographic MED-HYCOS stations Internet selection tool*



Home Page of the MED-HYCOS CD-ROM

3.3 The Data Collecting Platforms Network (DCPN)

The MED-HYCOS Data Collecting Platforms (DCPs) are designed to measure different parameters for water quantity and quality assessment (water level, water temperature, pH, conductivity, turbidity, dissolved oxygen) and meteorology (air temperature, humidity, solar radiation, atmospheric pressure). The DCPs are equipped with METEOSAT transmitters which provide real time data every three hours.

The DCPs have been installed in Albania, Bosnia-Herzegovina, Bulgaria, Cyprus, Croatia, Greece, Jordan, FYR Macedonia, Malta, Morocco, Slovenia, Tunisia and Turkey. At the end of the year 2000, 35 DCPs are planned to operate in these countries as well as in Algeria, Lebanon and Palestinian Territories (see Annex 4) . In addition to the DCPs provided by the project, Italy has installed five new DCPs whose data are made available to the MED-HYCOS data bank.

Furthermore, this network has been complemented by a secondary network of Near Real Time Stations (NRTS), established in Albania, Bulgaria, Spain, France, Italy, Greece, Slovenia and Romania. This secondary network is composed of stations equipped with conventional data collection devices. Data from these stations are supplied to the RDB weekly or monthly.



The Hydrometeorological Data Collecting Platforms MED-HYCOS (DCP)

3.4 The component "Training and Expertise"



Training session in Croatia

Training sessions have been organised with professional staff from all the participating countries in the field of:

- "DCP installation and maintenance" in Toulouse, France (1996) and in Metkovic, Croatia (1997).
- "Digital Elevation models applied to Hydrology" :Beirut, Lebanon (June 1999)
- "New technologies applied to Hydrology": Montpellier, France (October/November 1999)
- "application de nouvelles technologies à l'hydrologie": Montpellier (September/October 2000)
- "Application of MED-HYCOS tools to National Data Bases": Montpellier (October 2000)

To support the installation of DCPs, experts from participating countries have carried out mission to support national technicians in this activities: in particular experts from Croatia, Romania and Slovenia have carried out missions to FYR Macedonia, Jordan and Bosnia Herzegovina respectively. A guideline on the "acquisition and achievement of baseline hydrological data" has been elaborated by IRD and published with the support of the Technical University of Construction of Bucharest (Romania). A "Hydrometry quality chart - Guide to good practices" has been published with the support of the French Ministry of Environment.

Through a secondment programme 7 experts from various participating countries (Albania, Bulgaria, Romania and Yugoslavia) have spent periods up to 24 months in the PRC, participating in the development of the MHIS.

3.5 MED-HYCOS collaborations

During the first phase, MED-HYCOS has established links with existing programs the Mediterranean area as BLUE PLAN, ARIDE project working on droughts, FRIEND-AMHY (regional hydrological studies), etc. which have already used data collected by MED-HYCOS program.

Furthermore, thanks to the use of new technologies, the data producers participating to the MED-HYCOS program would fulfil better the needs of water managers and research teams for the assessment of the impact of human impact activities on the aquatic environment, for the evaluation of the pollution flows into the Mediterranean Sea, for the management and the protection of water resources, etc.

4. MED-HYCOS Project Future : Phase II

4.1 Project Justification

During the implementation of first phase of the project it was understood that it was possible to achieve only some of the objectives of the WHYCOS programme, due to both the limited availability of the resources and the experimental character of the project, which was, as repeatedly stated, the first WHYCOS component ever implemented. The major achievements are described in the previous chapter, and can be summarized as follows:

- Establishment of a minimum regional observing network;
- Establishment of a regional information system;
- Training courses;
- Development of regional co-operation among NHSs;

The participating countries appreciated the results of the first phase but felt the need to expand the scope of the project in order to:

- Ensure wider and denser regional coverage by the observing network, increasing also the number of real time stations;
- Increase the amount of data and information available in the Regional Data Bank;
- Make use of the data and information available at regional and national level to generate new information products for all category of user;
- Reinforce the co-operation links established between participating NHSs;
- Transfer at national level the technologies and tools developed by the PRC in order to enhance national management capabilities.

The achievement of these results is seen as a way for the NHSs to acquire skills, capabilities and means to better fulfil their role in support of national socio-economic development and environmental protection.

4.2 Project Description

During the second phase of the project, the achievements of the first phase will be consolidated, and be transferred from the regional to the national level.

The main objective of MED-HYCOS Phase II is to further develop, through the strengthening of the National Hydrological Services, the **Mediterranean Hydrological Information System** and its capacity to provide to a

large community of users, region-wide hydrological data and water related thematic products based on the information supplied by national systems and other region-wide management and scientific programmes.

The main focus will be:

- on the implementation at national level of **National Hydrological Information Systems (NHIS)** according to commonly agreed standards, providing a minimum set of data and information products (see 4.3.1) targeting end users' needs and using real time data acquisition/processing technologies and Internet oriented tools developed at regional level,
- on strengthening the **National Hydrological Services (NHS)** capabilities to maintain, sustain and develop such information systems at national and regional level, according to commonly agreed standards in order to provide a minimum set of information products targeting end users' needs; and
- on improving and fostering co-operation among NHSs and with regional research projects and institutions, also through the implementation of **Thematic Centres (TC)**.

The first beneficiaries of the project are the participating National Hydrological Services themselves, which will draw advantages in undertaking their operational and research activities from quicker and easier access to their own data, improved data management practices and up-to-date tools for data analysis and better capabilities to respond to user requirements.

At national and regional levels, other beneficiaries will be water managers and policy/decision makers, who will benefit from the synthetic, scientifically sound decision support tools, and user friendly, easily accessible and constantly updated information available from national and regional hydrological information systems.

At regional and global levels finally the research community will benefit from the increased availability of data, their better real coverage, and enhanced quality control.

4.3 Project Outputs

The anticipated project outputs are of two types:

- Hydrological data and information products, developed at national or regional level, regularly maintained and updated, and made available through Internet and other media such as CD-ROMs, and
- Strengthened capacity of NHSs to ensure the long-term sustainability of the national and regional hydrological information systems.

4.3.1 Hydrological data and information products

At national level

At national level the main project output will be the establishment of National **Hydrological Information System (NHIS)**, accessible via Internet, regularly updated by the NHS concerned, providing a minimum set of hydrological data and information products targeting end users' needs.

At national level, provisional list of the set of products in form of texts, tables, graphs or maps displayed by the **NHIS** is:

Form of presentation	Product
<i>Water resources - trends and availability</i>	
Bulletins	comments on the water resources situation and forecast
	assessment of extreme events
Maps	streamflow discharges (as percentiles) for each station
	dams (rate of filling)
	groundwater (levels and trends)
Graphs	river discharges: yearly hydrographs of daily values
	graphical rendition of historical series at yearly, monthly or daily aggregation levels
Tables	monthly and daily data on representative stations
<i>Water quality</i>	
Bulletins	comments on the situation and forecast
Maps	synthetic information on surface water quality

Graphs	evolution of quality parameters and indexes
Tables	sample data on representative stations
Rainfall information	
Bulletins	comments on the situation (and forecast, in association with NMS, when appropriate)
Maps	isohyetes curves for monthly values and monthly deviations from average
	isohyetes curves for exceptional events
Graphs	monthly data and average
	Intensity/period/frequency curves and exceptional events assessment
Tables	rainfall daily data on representative stations

At regional level

At regional level the Mediterranean Hydrological Information System (**MHIS**) will be developed, through the networking of the National Hydrological Information Systems (**NHIS**), and using the data, information and products developed by the MED-HYCOS Co-ordinating Centre (**MHCC**) and the Thematic Centres (**TC**).

At Mediterranean basin level, the major outputs of MHIS will be information on the project activities, information on the variability of the water cycle components, and specific products generated also making use of spatialized and remote sensing data.

- Information on project activities essentially produced by MHCC will be :
 - general information on the project activities,
 - presentation of the project partners,
 - activity and meeting reports,
 - bibliography, etc.
- Information on the variability of the water cycle components at regional scale essentially produced by TC or NHS themselves will be such as :
 - permanent evaluation of the surface water resources evolution for the major river basins,
 - statistical analysis of hydrometeorological data at regional scale,
 - diagnostics on region wide droughts and floods,
 - elaboration and monitoring of water quality indexes,
 - inventory of different water resources uses (storage, transfer, withdrawal and return flows),
 - inputs to the evaluation of the climate change on the water resources availability,
 - description and follow-up of the physical, biological and socio-economical environment of the major river basins of the region, etc.
- Spatialized information and products generated by TC making use of satellite data and ground data would be also developed at regional level to be later on operationally implemented at national level. They will address the following areas :
 - improvement of the forecasting of natural hazards, especially floods and droughts,
 - spatialisation of hydrological parameters as rainfall and evapotranspiration,
 - improvement of the linkages between hydrological and meteorological forecasting activities,
 - determination of the physical characteristics of the river basins,
 - estimation of the extension of pollution flow into the sea,
 - provision of consistent and extensive data for international river basins, etc.

Hydrometeorological data dissemination policy

The NHIS will allow access to a set of national data and to information products, in accordance with the prevailing national regulations in this field.

Different rights and rules of access could be established for different types of users. However as a general rule WMO Res. 25 - CgXIII "Exchange of hydrological data and products" will serve as the guidelines concerning the international exchange of data.

Following the practices implemented during the phase I, all data provided by stations equipped with DCPs under the two project phases will be freely accessible to all users. The NHIS will also be invited to continue to provide near real time data and historical data freely accessible from other national stations.

4.3.2 Strengthened capacity in NHSs

Through the planned training, secondment of experts to the MHCC and TC, and through technology transfer activities, MED-HYCOS will improve the capabilities of the partner National Hydrological Services in the areas of data acquisition, processing, and dissemination, maintenance of hydrological information systems, and will also contribute to improving the availability of reliable information on water resources

At the end of the project, each NHS is expected to have the capacities to undertake independently the maintenance, updating and further development of its hydrological information system, as well as to actively contribute to the regional information system. This will require the training of the NHSs staff in the domains relevant to the project outputs (data collection networks, data base management, web oriented programming, etc), on the job training through secondment of national experts to the MHCC and the TC. Basic equipment necessary to support the information system, ranging from data collection devices to computers and peripherals will also be provided. It is anticipated that by the completion of the project, each participating NHS will have available staff trained in the following fields.

- Website design and maintenance
- Internet interface maintenance
- Data base management
- Cartographic and GIS tools
- DCP installation, management and maintenance

Furthermore other training courses, workshops and seminars will be held to update NHSs' staff skills in the various fields of hydrology.

Each NHS will also be provided with the necessary equipment required for the operation of the hydrological information system (computer, software, telecom connections, etc.) Traditional field hydrological equipment (current meters, etc) as well as DCPs will be supplied to reinforce the national data collection systems and provide a more homogeneous real time coverage of the Mediterranean basin.

4.4 Actions

4.4.1 National Hydrological Information System

Each National Hydrological Service will develop and maintain its own National Hydrological Information System (NHIS), the related database and the interfaced web site. This information system will be hosted by a Server interfaced with Internet and managed by NHS. Temporarily it could be hosted by a Thematic Centre or the MHCC while the country is provided with necessary equipment and related skills necessary for its maintenance.

A National Hydrological Information System will be based on a Data Base Management System (MH DBMS) and the software tools allowing the access to and the retrieval, processing and dissemination of data and information through a web interface

The national database will contain the following information and types of data:

- Text information (stations descriptions, activity reports, etc.),
- Multimedia files (pictures, video, etc.),
- Chronological numerical series (water level, discharges, rainfall, water T°, etc.):
 - historical series from existing national data bases,
 - near real time data from selected stations;
 - real time data from automatic stations.
- Cartographic data (vector and raster format) :
 - Station location
 - Rivers
 - Basin boundaries
 - Political and administrative boundaries
 - Geomorphological features
 - Land use / land cover

Using the newest technologies, MH DBMS allows managing all these different types of data and information, displaying through Internet the outputs described above.

This DBMS and the related tools will be provided by the Project to the partner NHS which are not equipped by such a system. Actual and potential users of the information products will be actively involved in the product definition during the development phase, with a view to orienting the development of the information system, at both national and regional level towards a Decision Support Tool (DST) based on distributed data and information.

A Web site structure and templates will be proposed to NHS by the Project.

The NHS will provide the necessary manpower to manage, continuously develop and update data and information. To develop the NHIS, four main areas will be addresses:

- Data acquisition
- Data processing and dissemination
- Products definition
- Web interfacing

Data acquisition

Each NHS participating in the project is running a network of observing stations. Historical and new data from these networks are generally fed in the national data banks.

Through the MED-HYCOS Project, the real time data acquisition capacity of the countries will be enhanced, notably by installing new DCPs or rehabilitating existing ones (improving telecommunication by satellite or telephone, providing new sensors, etc.) on the location of hydrological stations or regional relevance.

The number of the data collecting platforms (DCP) provided by the project for real-time automatic data acquisition and transmission through the METEOSAT satellite system will be increased from 35 (at the end of first phase) to 115 stations (at the end of the second phase after the installation of 20 stations per year). The location of these additional stations will be selected in such a way to ensure a better coverage of the Mediterranean basin as proposed in annex 5.

All real time data and validated data from stations equipped with DCPs by the project as well as data from selected national stations of regional significance will be fed into the NHIS established in the framework of MED-HYCOS.

Data processing

The majority of countries participating in the Project have developed national databanks (NDB). However in most of cases only data series are stored. Furthermore the architecture of the databanks and the software employed is not state-of-the-art and must be improved to facilitate the access and retrieval of data, the elaboration of spatialized information and the interfacing of the databank with internet.

MED-HYCOS Project will support NHS to improve their data managing and processing procedures notably through providing advice on and support for the implementation of National Hydrological Information System using the MED-HYCOS Data Base Management System:

- Integrating real-time data from DCPs and satellite based remotely-sensed information,
- Developing data quality control methodologies and tools at national and regional levels based on normalised results;
- Increasing the number of long historical series of hydrological data contributing to the Mediterranean Hydrological Information System ;
- Implementing software tools to manage these data at national level, and
- Creating mechanisms to improve, both at national and regional levels intersectoral collaboration for the collection and validation of data and information in the fields of water quantity, quality and use, watershed characteristics, existing and planned hydraulic structures, etc. to be included in NHIS, involving governmental agencies, research institutes and academic bodies.

Products definition and elaboration

The detail of the information products defined above, as well as new product as required, will be identified and defined through a multiple approach consultative process between the NHSSs, the TC and the MHCC on one side and the final users on the other side.

The consultation process will be carried out through the following means:

- A forum on the web site hosting the hydrological information system, allowing users to provide comments, suggestions and requests.
- A continuous direct consultation process with the major users of hydrological information, such as other state agencies (civil defence, ministries of agriculture, of environment, of public works, etc.), research institutions, universities, etc..

- Regular meetings at national and regional level gathering actual and potential users of information. organized to familiarise users with the Information systems and their tools, as well as for collecting feedback for further developments

Web interfacing and data dissemination

Although most of the participating NHS have developed a Web site, many of them start just now to use largely the Internet technologies and move their hydrological web-sites from a static presentation of the NHS to a more dynamic system for the provision of data and information.

The experience earned during the development of the MED-HYCOS web pages will be used for enhancing and expanding the existing web sites of NHSs, or to create new ones, when necessary. The sharing of a similar layout for web sites and associated database will also allow easy cross linkage between the national and regional components of the Information System.

During the first phase of MED-HYCOS a set of tools (MED-DAT, MED-MAP and MED-CLIM) for accessing via Internet the data stored in the Regional Database have been developed by the PRC with the support of computer experts from participating countries. These include:

All these tools are able to work in transparent way accessing both remote databases via internet and local data bases (on HD or CD-ROM) provided that the format are compatible.

During the phase II these tools will be transferred to the NHSs to be used for accessing their national databases.

4.4.2 Training

Training courses will be organised to transfer the MED-HYCOS tools developed by the project to national level and to build the NHS capacities to sustain the project activities in the long term.

These training courses will address the following topics:

- Hydrometry and hydrological data acquisition;
- Hydrological data processing and management;
- Internet technologies and data dissemination;
- Geographical Information System;
- Digital elevation models;
- Remote sensing data.

The proposed content of the training courses will be as follows.

Hydrometry and data acquisition

- Location of hydrometric stations;
- Limnometry and data loggers;
- Discharges measurement;
- Calibration of rating curves;
- Data transmission;
- Levelling survey;
- Bathymetry.

Data processing and management.

- General information
- Definition and purpose of databases;
- Structuring and accessing a hydrological database;
- ORACLE database, main features, use
- MS Access database, main features, use
- MED-DAT : Data management tool, general presentation, features, use
- MED-CLIM : climatic viewer, general presentation, features, use
- Creating a national database based on MED-HYCOS database and tools.

Internet technologies and data dissemination

- General Information ;
- Overview of Internet languages: html, xml, vml, etc. ;
- Server and web site updating and management ;
- Web Sites technology, design and implementation ;
- CD-ROM bundle
- Creating a national web site and CD-ROM

Geographical Information Systems

- General Information on GIS ;
- Application of GIS technology to hydrology ;
- MAP-INFO: main features, use ;
- MED-HYCOS maps, creation and storage of the maps in the database ;
- MED-MAP: mapping tool: general presentation, features, use ;
- Creating a national cartographic database.

Digital Elevation Models

- General Information on DEM ;
- Application of DEM to hydrology ;
- DEMIURGE and NTT software use ;
- Catchments of the Mediterranean area.

Remote Sensing Data Use

- General Information on RSD ;
- Application of RDS to hydrology and Mediterranean region.

The training courses will be organised in specialised Thematic Centres which could provide necessary facilities (rooms, computers, etc.). Teachers will be selected among the experts of the partner countries according to their skills in the concerned fields.

Training support will be available for all the project partners in the framework of the organisation of the training sessions and of self-training in co-operation with organisations involved in this type of activities.

4.4.3 Regional Hydrological Information System

The MHIS is formed by the NETWORKING of the NHIS (see 4.3.1), which will focus more on national issues, and a regional component, which will provide data and information at regional scale. The regional Web site will also be the main gate for accessing the other NHIS components.

The present scope of the MED-HYCOS web site will be enlarged to the possible extent to other aspects of water and water related issues in the Mediterranean - water supply, climate and weather aspects related to water resources, sea water and fresh water

The regional component of the project's hydrological information system will be developed starting from the present MHIS structure, based on

- i) a Regional Data Base,
- ii) a series of tools allowing the retrieval, elaboration of data and their rendering in tabular, graphical or cartographic form and the elaboration and display of the information products described in the document, and
- iii) a system for disseminating the data and information (including Internet, CD-ROMs, etc.).

Regional Data Base

The regional data base developed during the project first phase, will be expanded by acquiring from NHSs new data through the following means:

- Real time data

- from the stations equipped with DCPs by the project (35 stations installed during first phase plus 80 existing stations, new stations to be installed or upgraded during the second phase). As for the first phase granting free and non-restricted access to station data will be the precondition for the project to supply a DCP to NHSs.
- from other DCPs, provided voluntarily by participating NHSs
- Near-real time data
 - from selected stations of regional significance. Data from these stations will be transferred by the NHS to the RDB at regular intervals (weekly, monthly)
- Historical data
 - from national data banks as well as, upon agreement, from data banks developed by regional projects such as FRIEND-AMHY, etc..

Real time and near real time data will be stored first before in raw format. The validated value will be supplied as soon as produced by the relevant NHS

MHIS tools

The tools developed during the first phase of the project will be further improved, and new ones will be developed to support the production and dissemination of the information product described before:

Dissemination system

The main access gate to the MHIS will be represented by the project Web site. It will be developed from the existing one and will include:

- General description of the project;
- Links to the NHS web sites and to National Information Systems;
- Description of the stations providing data to RDB;
- On line or downloadable tools for dynamic access to RDB and MHIS;
- Bulletins and other static information products.

The web site will be regularly mirrored into a CD-ROM for facilitating its use to user with slow / expensive Internet access. The CD-ROM will be widely distributed to all potential and actual user region- and world-wide.

Finally a mail list will be created for distribution of newsletter about project activities, covering regional and national aspects.

The MHIS, including regional data bank, the associate tools and the dissemination system, will be maintained and managed by the Regional Co-ordination Centre in co-ordination with and with support from the NHS and the TC. The support will be in form of both contribution to the development of specific parts of the MHIS carried out by the NHS or TC, or in form of secondment of experts to the MHCC for limited period of time. The staff requirements of the MHCC are:

- Webmaster
- Databank manager
- Tool developers
- Product developers

4.5 Project Management

At National level the main project actors will be the NHS, that will create develop and maintain the hydrological information systems by the using their own physical means and human resources. The Project will contribute to strengthening these capabilities whenever needed.

At regional level, Thematic Centres hosted by existing institutions (NHS, Research Institutes, Universities, other Regional bodies) will be in charge of the development of one or more of the regional products mentioned above.

One of the Thematic Centres will act as Regional Co-ordinating Centre supervising and harmonising the implementation of Project activities and providing technical backstopping to participating NHS.

The supervising agency (WMO) will provide the scientific and technical backstopping to the project activities, and will ensure that they will be carried out in accordance and in compliance with the global WHYCOS concept and in co-ordination with the other ongoing HYCOS components.

The overall control over project implementation will be done by the Regional Co-ordinating Group whose membership are all project partners.

National Hydrological Services

The MED-HYCOS partners will be the **National Hydrological Services** of Mediterranean Sea countries already involved at different levels of commitment in the first initial phase (1995-2000) as presented in Annex 1.

These countries are:

Albania, Algeria, Bosnia-Herzegovina, Bulgaria, Cyprus, Croatia, Spain, France, Greece, Italy, Jordan, Lebanon, FYR Macedonia, Malta, Morocco, Portugal, Palestinian Territories, Slovenia, Tunisia, Turkey, Yugoslavia.

It is expected that Egypt, Israel, Libya and Syria will join the project during the next phase.

Besides, scientific partners and water actors will be identified in order to co-operate with the National Hydrological Services to design and/or to elaborate added value products meeting the needs of end-users.

The main responsibilities of the NHSs will be.

- (i) performing regular maintenance operations of the observing network and routine hydrometrical activities ;
- (ii) ensuring the daily data collection from the DCPs installed by the project ;
- (iii) checking the quality of received raw data ;
- (iv) performing regular data validation ;
- (v) with the support of the Project, ensuring the implementation, development and maintenance of the National Hydrological Information System (NHIS) and related tools as a part of the Mediterranean Hydrological Information System (MHIS) ;
- (vi) updating NHIS by entering new raw data (real time, near-real time) in the national database, as well as validated data and related products, according to the contracted agreement ;
- (vii) liaising with end users to ensure that project outputs meet their requirement ;
- (viii) if possible seconding staff to the MHCC to support regional activities and the development of the MHIS ;
- (ix) making available staff for attendance in the training courses ;
- (x) drawing up 6-monthly progress reports of national activities ;

Regional Co-ordinating Group

A Regional Co-ordinating Group (RCG) will be set up, whose membership will include representatives of all the participating NHS, of TC and MHCC as well as of the supervising agency, of donors and of partner institutions.

The main responsibility of the Regional Co-ordination Group will be:

- (i) Provide general guidance to the project implementation ;
- (ii) Revising and approving the implementation plan, schedule and sharing of activities between NHS, TC and MHCC ;
- (iii) Discussing and approving the location of DCPs, the design of the development of the MHIS, the organization of training programmes ;
- (iv) Harmonising regional and national activities ;
- (v) Defining, orienting and following up on the institutional, financial and budgetary policy of the project.

Supervising Agency

The World Meteorological Organization will be the supervising agency

WMO will:

- i) provide general scientific supervision and overview project implementation ;
- ii) ensure that the project is implemented according to the WHYCOS principles established by the WIAG (whose memberships includes donors, representatives of each ongoing projects, etc.);
- iii) provide technical backstopping related to WMO expertise fields ;
- iv) ensure access to free satellite data transmission by including WHYCOS as WMO programme.

MED-HYCOS Co-ordinating Centre

The MED-HYCOS Co-ordinating Centre (MHCC), under the guidance of the Regional Co-ordinating Group (RCG) and with the support of the Supervising Agency, would be responsible for:

- (i) the implementation of the decisions and recommendations of RCG ;
- (ii) the general co-ordination of the program and aspects dealing with administration and finance, including the preparation of contracts ;
- (iii) the technical, scientific and institutional aspects related to all the implementation of the programme. In particular, it will be responsible for co-ordinate and supervise :
 - in co-operation with the NHS the implementation of the national NHISs,
 - in co-operation with NHS and TC, the development of the MHIS, and,
 - the organization of the training events.

Since 1995, the Pilot Regional Centre is hosted by the Institute of Research for Development (formerly ORSTOM) in Montpellier - France.

It is proposed that during the coming phase (2001-2004), the project will be co-ordinated by the **Institute of Research for Development** (IRD) under the auspices of the World Meteorological Organisation.

The contribution of IRD to the MED-HYCOS implementation is part of a global approach of the Institute that aims to develop multimedia knowledge bases on environment and meet the demand of the international community to have access to efficient information on water at a regional scale (Observatory concept).

Thematic Centres

The activity of the MHCC addressing regional issues will be supported by Thematic Centres (TC) hosted by existing institutions (NHS, Research Institutes, Universities, other Regional bodies) in the region, which will provide their inputs in specific fields

The TCs shall have available data and information on water resources assessment and management and hydrological phenomena as well as on climate and environment.

TC will be established to address the following fields:

- Water resources availability,
- Water Quality Survey,
- Water management and uses,
- Droughts diagnostics and forecast,
- Floods evaluation and predetermination,
- Climate change,
- Anthropogenic impacts on water resources,
- Training activities

The TC will get water related information from the National Hydrological Information Systems and shall have access to other sources of complementary information (climate, environment, socio-economic, land use, etc.) in order to produce the expected outputs.

The organisation hosting one TC will provide the necessary manpower to fulfil its mandate. MED-HYCOS Project could partly contribute to the financial support of the equipment and functioning of the TC activities. The TC activities may be co-financed by other research programmes whenever common interests are identified.

Co-operations will be established with other projects addressing water related issues in the Mediterranean such as: EMWISS, INWEB, PLAN BLEU, EI JRC ISPRA, SSO (Observatoire du Sahara et du Sahel), ROSELT (Réseau d'Observatoires sur l'Environnement à Long Terme), etc.

4.6 Summary Budget

The budget of MED-HYCOS Project during the Phase II (2001-2004) is based on one scenario of activities assuming the participation of 25 countries. It is supposed that around 15 of them will need the support of the project to implement their own NHIS.

This scenario consists in:

At national level:

- (i) implementing National Hydrological Information Systems in the partner countries and improving them with the real time (DCPs), near real time and historical data and related information and products ;
- (ii) reinforcing the DCP Network up to 115 DCP by installing or upgrading every year 20 new DCP, a part of them being equipped with water quality and/or meteorology sensors starting from the present status at the end of 2000 of 35 DCP installed or being installed;

At regional level:

- (iii) implementing new tools to enhance the hydrological information including Geographical Information System merging data on water resources and water uses;
- (iv) maintaining and updating the Regional Data Base;
- (v) improving the regional Mediterranean Hydrological Information System (MHIS) with water related information products elaborated by the MHCC, the participating NHSs and TCs;
- (vi) updating the MED-HYCOS Web site and publishing periodically a CD-ROM including a copy of the MHIS ;
- (vii) organising training courses ;
- (viii) driving a co-operation network between the National Hydrological Services favouring exchange of data and information.

Participating NHSs are supposed to contribute in cash and kind to the project activities, in particular by ensuring:

- Installation of DCPs (material for the site preparation, manpower) and their operation and maintenance;
- Staff for undertaking the activities related to the development of NHIS and for supplying data and information to the RDB and MHS;
- Seconded staff to assist the activities of the MHCC;
- Experts for undertaking support missions to the participating countries.

4.7 Assumptions and risks

4.7.1 Assumptions

The project design is based on a number of assumptions:

- The free use of METEOSAT satellite for data transmission will continue to be available to the project, as being part of a WMO programme,
- Data will continue to be retrievable by the project partners via internet from the EUMETSAT web server,
- The project's infrastructure will not suffer deliberate or accidental loss or damage beyond that for which prudent provision have been made (mainly spare parts for DCPs as a function of MTBF),
- The supervising agency, the RCC, the TCs and the NHSs will be able to establish effective working relations among them and with other stakeholders, in particular the external beneficiaries of the information system,
- Government of participating countries and their ministries or departments in charge for water affairs will agree to their NHSs and the other institution hosting TCs taking responsibility for the routine project activities,
- NHS and organisations hosting TC and RCC will be willing to take responsibility for the project's routine tasks, and will be able to make available the staff-time required,
- NHS staff who are trained by the project will be retained by their Service, or it will be possible to train replacements to continue the project activities as scheduled.

4.7.2 Risks

The major risks in the project implementation are related to the non achievement of the following objectives:

- Responding to the real requirements of end users and stakeholders with the data and information provided through the national and regional hydrological information system
- Building in the NHSs the required capacity to develop and maintain the National Hydrological Information Systems,
- Developing in the NHSs ownership of the system, so as to ensure that they will assume responsibility for maintaining the systems by the end of the project

The potential risks will be addressed as follows:

i) The provision of data and information is the aim of the project. To ensure the project to be successful, data and particularly information have to be those required by the end users, which in many cases may be not professional hydrologists. Failure to create a group of "customers" relying on the project outputs for their activities would mean the non-sustainability of the project in the short to medium term after the end of the external support. It is therefore essential that any efforts be placed in determining what are the expectations of the end users, and in setting up an appropriate mechanism allowing:

- Identification of potential users
- Identification of their needs
- Feedback from users to project team to adapt products to their changing or new needs

In the project implementation provisions are done, as described above, to set up such a mechanism, through the use of regular consultations, electronic fora, mailing lists, etc..

ii) The present capabilities of NHSs are variables, both in terms of staff skill and equipment. Through the project NHSs will be provided with the necessary equipment for supporting the hydrological information systems (from data collection to computer and software). The major risk in connection with this action is represented by the delays in the installation of the equipment (essentially field equipment, first and foremost DCPs) and in telecommunication network problems and deficiencies or access costs. Concerning the equipment, based on the experience earned during the first phase, the following measures can be taken to streamline the installation:

- Equipment will be shipped only upon reception of a formal engagement from the country to install it in a set timeframe. This will include also the readiness to cover the installation costs (civil works, travel and manpower), at least on a cost-sharing basis with the project.
- Provision will be made in the project budget to support on a cost-sharing base, when required, the installation of equipment
- Experts from participating countries with extensive experience in equipment installation will carry out technical support mission to the countries needing them.

The reliability of telecommunication networks does not represent a major issue nowadays in Europe, even in the Balcanic areas devastated by the war, where major reconstruction efforts are being deployed. The speed of Internet connections is constantly increasing, while the cost of communication is decreasing: Furthermore the great majority of the NHSs involved is already maintaining a Web site. Therefore major difficulties are not anticipated in connecting the National Hydrological Information system with the Web and or in their being accessed by the end users, while the MHIS has already proven its viability during the first phase. However mirror sites could always be hosted by the MHCC or the TC, and the regular issuing of CD-ROM will allow the continuous access to data, even in case of temporary interruptions of the connections.

Provisions are made to train NHS staff in the technological fields required to carry out the project activities. Training sessions have proven as one of the most successful activities carried out during the first phase and the attendance of participants with the required background to fully benefit from the training event is not an anticipated risk. The major risks in this connection reside in the inability of the train staff to apply the new expertise in their everyday work. To minimise this risk the following measures can be taken:

- Carefully plan the timing between the training courses and the delivery to countries of the equipment necessary to the new skills (DCPs, computers, software, etc.)
- Ensure that the staff proposed for the training course is that one who, within the NHS, has the actual responsibility for undertaking the activities it which he/she is going to be trained.

iii) It is anticipated that ownership of the project at national level can be built only if the NHSs perceive the hydrological information system developed within the project's frame as a tool for providing better services to their customers and get enhanced recognition of the role they can play in support of economic development, protection of life and property and environmental conservation. To do so it is essential that the national hydrological information systems developed respond to users needs and are sustained by the capacities of NHSs. These two aspects have been addressed in the previous paragraphs.

At regional level the hydrological information system will be sustained by the contribution of the NHSs and TCs. In this case too the viability of the regional system depends basically on its capacity to deliver information products and data to the end-user and on the technical capacities of the NHSs and TCs to produce this information and supply these data. Furthermore the regional system should be recognized by the NHSs as a part of their strategy to promote their role and visibility beyond the bare national context.

5. Annex 1 : List of the MED-HYCOS Partners - Phase I

Country	Organisms and address
ALBANIA	Hydrometeorological Institute Rruga Durrësit, 219, Tirana, Albania
ALGERIA	Agence Nationale des Ressources Hydrauliques Ministère de l'Équipement et de l'Aménagement du Territoire Clairbois, Avenue Mohameddi-Bir-Mourad - Rais 16 000 Alger, Algérie
BOSNIA-HERZEGOVINA	Federal Meteorological Institute Bardakcije 12, Sarajevo, Bosnia-Herzegovina
BULGARIA	National Institute of Meteorology and Hydrology BAS 66, Tzarigradsko Shose Boul 1784, Sofia, Bulgaria
CROATIA	Meteorological and Hydrological Service Gric 3, Hrvatska, 10 000 Zagreb, Croatia
CYPRUS	Water Development Department Ministry of Agriculture Natural Resources & Environment CY-1413 Nicosia Cyprus
FRANCE	Ministère de l'Environnement Direction de l'Eau 20 rue Ségur 75302 Paris France
GEORGIA	Department of Hydrometeorology 150 David Agmashenebeli Ave 380012 Tbilisi, Georgia
GREECE	Hellenic National Meteorological Service GR 16777 Hellinikon PO Box 73502 ATHENES
ITALY	Servizio Idrografico e Mareografico Nazionale Dipartimento Servizi Tecnici Nazionali Presidenza del Consiglio dei Ministri Via Curtatone, 3; I-00185 ROMA
JORDAN	Ministry of Water and Irrigation Planning, Development and Information P.O. BOX 2412; AMMAN
LEBANON	Ministère des Ressources en Eau et Electricité du Liban Rue du Fleuve - BEYROUTH
F.Y.R MACEDONIA	Republic Hydrometeorological Institute Street Skupi b.b.; SKOPJE 91000
MALTA	Water Services Corporation Qormi Road; LUQA LQA 05

MOLDOVA	Hidrometeo Service (Chimet) 93 Grenoble; 277043 CHISINAU
MOROCCO	Ministère des Travaux Publics Direction Générale de l'Hydraulique Rue Hassan Ben Chekroun; RABAT
PALESTINIAN TERRITORIES	Palestinian Water Authority P.O. Box 891, Ramallah, West Bank, Palestine
PORTUGAL	Instituto de Agua Avenida Almirante Gago Coutinho, 30; 1000 LISBOA
ROMANIA	National Institute of Meteorology and Hydrology 97, Bucuresti, Ploiesti, 71552 Bucharest, Romania
SLOVENIA	Hydrometeorological Institute of Slovenia Vojkova, 1/b; 1001 LJUBLIANA SLOVENIA
SPAIN	Ministry of Environment General Direction of Hydraulic Works and Quality of Waters Plaza San Juan de la Cruz, 28071, Madrid, España
TUNISIA	Ministère de l'Agriculture Direction Générale des Ressources en Eau 41-43 Rue De La Manoubia, Monyfleury, 1008 Tunis
TURKEY	Ministry of Energy and Natural Resources Direction of State Hydraulic Works (DSI) DSI Genel Müdürlüğü, Yücetepe, 06100 Ankara
UKRAINE	State Committee for Hydrometeorology 6, Zolotovorotskaya Street 252601 MSP; KIEV 34
YUGOSLAVIA	Federal Hydrometeorological Institute Bircaninova 6, P.O. Box 604; 11001 BELGRADE

6. Annex 2 : Budget of the MED-HYCOS Phase I - Period 1995 - 2000

Budget of Med-Hycos Phase I activities including national contributions

YEAR	PRC	DCP network	MHIS	Support	Co-operation	Total
1996	18 000	49 000	2 400		1 000	70 400
1997	18 000	41 000	22 000	10 100	49 000	140 100
1998	18 000	1 200	0	0	24 400	43 600
1999	18 000	11 000	92 800	33 800	21 600	177 200
2000	18 000	20 000	82 000	20 000	40 000	180 000
Total	90 000	122 200	199 200	63 900	136 000	611 300

7. Annex 3: MED-HYCOS Tools

MedMap 3.0

MedMap is an application providing access to the MED-HYCOS database through a map interface. Two databases are accessed by default:

1. MED-HYCOS Internet Oracle database (using HTTP protocol) and
2. MED-HYCOS local Access database (using ODBC drivers) supplied on the MED-HYCOS CD-ROM.

In addition other databases can be accessed, provided that they respect the format requirements.

Geographical objects are stored in the database as vectors and are organized in four layers: Countries, Basins, Rivers and Stations. Raster image, representing terrain elevation, is also available. Common GIS software options such as zooming, moving, switching layers on and off, etc are available.

Objects created on the map are also displayed on the screen in a separate frame as a tree-structured copy of the database. The tree nodes are interactively connected with the map, selection on the map means selection on the tree panel and vice-versa. Opening of the tree node gives access to a set of sub-objects, e.g. opening of the node with one country name gives access to the set of sub-nodes representing all the stations in the database available for the selected country. An information frame, attached to the map canvas, gives general information about the selected station.

The final result of a database query is the data series for the selected set "Station/Variable/Aggregation Level" on the tree panel. Datasets can be displayed in three forms: two types of graphs (yearly or monthly graph) and as a table. Graphs give the possibility of superposing datasets from several stations, different years, basic statistic display, as well as zooming and moving. MedMap provides the possibility of printing (map and graph panels), copying (table and info panels), exporting in WMF and GIF files (map and graph panels) and exporting in ASCII files (info and table panels). The possibility of creating "custom" map for any region is included as well. User can change almost all the settings concerning map and graph colours selection and object sizes. MedMap is written in Tcl/Tk 8.3.

MedDat 2.0

MedDat applications has been developed for managing the MED-HYCOS Regional database

It allows the following operations:

- (a) Retrieval of DCPs three hourly data from EUMETSAT site or any other FTP site,
- (b) Ingestion of historical or real-time (DCP) data into a local Access database and their transmission to the Oracle Database hosted by the project PRC in Montpellier
- (c) Maintenance of the Access database: adding new object such as new stations, basins, rivers, countries and new variables attached to these objects
- (d) Maintenance of the Oracle database
- (e) Visual statistical analysis of data series
- (f) Changes in the data aggregation level (e.g. daily data into weekly or monthly data)
- (g) Data editing
- (h) Data export in ASCII format for further use with other software applications, and in image format for use in reports and presentations

MedClim

The main purpose of the tool MedClim is the visualisation and graphical (linear and spatial) representation of climatic data from the Mediterranean region, namely monthly rainfall and temperature values, including the derived data (averaged monthly and yearly data).

Available data:

1. monthly temperature, data from 629 stations (25612 years)
2. monthly rainfall from 472 stations (33550 years)
from 24 countries in the Mediterranean region.

This data has been retrieved from the Webster of the "Global Historical Climatology Network".

For monthly temperature, data from 629 stations (25612 years), for monthly rainfall from 472 stations (33550 years), from 24 countries in the Mediterranean region. The data have been retrieved from the Webster of the "Global Historical Climatology Network".

Beside the time-series representation a module for spatial interpolation is available. The spatial interpolation can be executed on the whole region or on a user-defined surface (basin, country or rectangular region), for all the

aggregations and variable combinations. Based on the interpolated values, basin average values were derived, for the existing 33 basins. An animated projection of the images can give a general overview on the changes over time.

The tool also provides the possibility of computing a surface-weighted average on user drawn region, based on interpolated values.

8. Annex 3 : DCP's Network phase I

MED-HYCOS database - names of stations equipped with DCPs are in bold

Country	Basin	River	Station
Albania	Drini	Drini Zi	Skavica
	Erzeni	Erzeni	Ndroq
	Ishmi	Gjolja	Ura Gjoles
	Mati	Mati	Shoshaj
	Semani	Devolli	Kokel
	Semani	Murrash	Paper
	Semani	Osumi	Ura Vajgurore
	Shkumbini	Shkumbini	Murrash
Bosnia	Zenica	Zenica	Razpotocje
Bulgaria	Marica	Chepelarska	Bachkovo
	Marica	Marica	Plodiv
	Marica	Sazliyka	Galabovo
	Marica	Tundja	Elhovo
	Mesta	Mesta	Momina kula
	Struma	Struma	Boboshevo
Croatia	Krka	Krka	Skradinski buk gornji
	Rasa	Rasa	Podpican
	Cetina	Cetina	Tisne stine
	Mirna	Mirna	Portonski most
	Neretva	Neretva	Metkovic
	Zrmanja	Zrmanja	Jankovica buk
	Zrmanja	Zrmanja	Muskovci
Cyprus	Dhiarizos	Dhiarizos	Arminou
	Dhiarizos	Dhiarizos	Germagoseia
	Dhiarizos	Dhiarizos	Philousa
	Serrakhis	Peristerona	Panayia Bridge
FRYMacedonia	Vardar	Vardar	Skopje
	Vardar	Vardar	Skopje2
France	Aude	Aude	Carcassonne
	Gapeau	Gapeau	Hyeres Sainte Eulalie
	Rhone	Rhone	Beaucaire
	Tech	Tech	Saint Paul sur Tech
	Vecchio	Vecchio	Pont de Noceta
Greece	Acheloos	Acheloos	Avlako
	Acheloos	Acheloos	Mexorora
	Aliakmon	Aliakmon	Il Arion
	Aoos	Aoos	Konitsa
	Arachtho	Arachtho	Tsimovo
	Mesta	Mesta	Temenos
Italy	Arno	Arno	San Giovanni

	Ofanto	Ofanto	S.Samuele Di Cafiero
	Pescara	Pescara	Santa Teresa
	Po	Po	Pontelagoscuro
	Po	Reno	Casalecchio
	Tevere	Tevere	Ripetta
Jordan	Zerqa	Zerqa	Jarash
Malta	Marsa	Marsa	Marsa
	Mforn	Mforn	Marsaforn
Morocco	Moulouya	Moulouya	Dar el Caid
Portugal	Algarve Eastern	Algarve	S. Bras de Alportel
	Algarve Eastern	Algarve	Santa Catarina Tavira
	Algarve Western	Algarve	Lagos
	Alportel	Alportel	Bodega
	Guadiana	Guadiana	Pulo do Lobo
	Guadiana	Guadiana	Serpa
	Sado	Sado	Moinho da Gamitinha
	Tagus	Tagus	Abrantes
	Tagus	Tagus	Tramagal
Romania	Danube	Danube	Ceatal Izmail
	Danube	Danube	Tulcea
	Danube	Prut	Raudauti
	Danube	Siret	Siret
Slovenia	Dragonja	Dragonja	Podkastel
	Soca	Idrija	Podroteja
	Soca	Soca	Krsovec
	Soca	Soca	Log Cezsoski
	Soca	Soca	Solkan
	Soca	Vipava	Dolenje
	Soca	Vipava	Miren
	Timav	Notranjska reka	Cerkvenikov mlin
Spain	Almanzora	Almanzora	Cantoria
	Ebro	Ebro	Tortosa
	Ebro	Ebro	Zaragoza
	Guadiaro	Guadiaro	San Pablo Buceite
	Jucar	Jucar	Alcala del Jucar
	Turia	Turia	La Presa
Tunisia	Mejerdah	Mejerdah	Ghardimaou
	Merguellil	Skhira	Kef El Abiodh
	Tessa	Tessa	Sidi Medienne
	Unknown	Unknown	El Feija
	Unknown	Unknown	Makthar
	Unknown	Unknown	Zouarine
	Zeroud	Hatab	Kanguet Zazia
Turkey	Ceyhan	Ceyhan	Misis
	Goksu	Goksu	Karahacili
	Kopru	Kopru	Karakaya

	Lamas	Lamas	Kizilgecit
	Marica	Marica	Kirishane
Ukraine	Danube	Danube	Izmail
	Dnieper	Dnieper	Nova Kakhovka
Yugoslavia	Danube	Danube	Bezdan
	Danube	Sava	Sremska Mitrovica
	Danube	Velika Morava	Ljubicevski Most
	Moraca	Moraca	Podgorica

9. Annex 5 : the DCP's network proposed for phase II

General information on future MED-HYCOS Acquisition Network Phase II

Note:

R -River Stage Recorder,

G- Staff Gauge,

DCP : DCP already installed in phase I

DCP II : DCP to be installed in the second phase

DCP II m : Meteorological DCP to be installed in the second phase

80 DCP must be installed during the first phase ; 11 of them are meteorological stations. Around 20 other DCP will be equipped with water quality sensors.

Country	Numéro station	Basin	River	Station	Area (km ²)	Present Equipment	DCP Phase I	DCP Phase II	Start of observations
1. Albania	1	Drini	Drini	Bahçallek	14173	G		DCP II	1947
	2	Devolli	Devolli	Kokel	1884	R			1952
	3	Drini	Drini Zi	Skavice	5562	R			1971
	4	Erzeni	Erzeni	Ndroq	663	R	DCP		1954
	5	Ishmi	Gjolja	Ura Gjoles	468	G			1950
	6	Mati	Mati	Shoshaj	646	R			1949
	7	Semani	Osumi	Ura Vajguraore	2073	R	DCP		1948
	8	Shkumbini	Shkumbini	Paper	1958	G			1950
	9	Shkumbini	Shkumbini	Murrash	1289	R		DCP II	1948
	10	Vjosa	Vjosa	Dorze	5424	R		DCP II	1957
2. Algeria	11	Chelif	Chelif	Sidi bel Atta	43700	R		DCP II	1946
	12	Cotieres algerois	El Harrach	Baraki	970	G			1971
	13	Macta	El Hammam	Trois Rivieres	7440	R		DCP II	1946
	14	Kebir Rhumel	El Kebir	El Ancer	8700	G			1970
	15	Isser	Isser	Lakhdaria	3615	R	DCP		1969

	16	Seybousse	Seybousse	Mirebeck	5955	R	DCP II	1952
	17	Soumman	Soumman	Sidi Yahia	8420	R	DCP II	1963
	18	Tafna	Tafna	Pierre du Chat	6900	R	DCP II	1952
3.Bosnia-Herzegovina	19	Zenica	Zenica	Raspotočje			DCP	
	20	Spring of Buna					DCP II	
4.Bulgaria	21	Maritza	Chepelarska	Bachkovo				
	22	Danube	Glava Panega	Zlatna Panega	300	R	DCP II	1959
	23	Kamchia	Kamchia	Beronovo	590	R	DCP II	1950
	24	Maritza	Maritza	Plovdiv	12730	R	DCP	1912
	25	Mesta	Mesta	Momina Kula	1510	R	DCP	1927
	26	Maritza	Sazliyka	Galabovo				
	27	Struma	Struma	Boboshevo				
	28	Shirokolashka	Shirokolashka	Beden				
	29	Tundja	Tundja	Elhovo	5550		DCP	1948
	30	Arda	Varbitza	Djebel				
5.Croatia	31	Cetina	Cetina	Tisne Stine 1	1456	R	DCP II	1966
	32	Krka	Krka	Skradinski buk Gornji	2285	R	DCP II	1922
	33	Mirna	Mirna	Portonski Most	483	R	DCP II	1955
	34	Neretva	Neretva	Metkovic	6819	R	DCP	1934
	35	Rasa	Rasa	Popdican	91	R		1963
	36	Zrmanja	Zrmanja	Jankovica Buk				
	37	Zrmanja	Zrmanja	Muskovič			DCP	
6.Cyprus	38	Dhiarizos	Dhiarizos	Arminou	125	R	DCP	1965
	39	Dhiarizos	Dhiarizos	Philousa			DCP	
	40	Searrakhis	Peristerona	Panayia Bridge	77	R	DCP	1955
7.Egypt	41	Delta of Nil	unknown	unknown			DCP II	
	42	coastal zone	unknown	unknown				
	43	coastal zone	unknown	unknown				
	44	coastal zone	unknown	unknown			2 DCP II	
8.France	45	mediterranean coast	Gapeau	Hyeres	517		DCP	1961

	46	Beaucaire	Rhone	Beaucaire	95590	G	DCP	1840
	47	mediterranean coast	Tech	Saint Paul sur Tech	473	R		1966
	48	mediterranean coast	Vecchio	Pont de Noceta	154		DCP	1959
	49	mediterranean coast	Aude	Carcassonne	11730	R		1957
	50	coastal zone	unknown	unknown				
	51	coastal zone	unknown	unknown				
	52	coastal zone	unknown	unknown			2 DCP II	
	53	Fontaine de Vaucluse					DCP II	
9.FYROM	54	Danube	Vardar	Skopje	4650	R	DCP	1954
	55	Drini	Crni Drim	Struga		R	DCP II	
10.Greece	56	Acheloos	Acheloos	Avlako				
	57	Acheloos	Acheloos	Mexorora				
	58	Aliakmon	Aliakmon	Il Arion				
	59	Aoos	Aoos	Konitsa				
	60	Arachtho	Arachtho	Tsimovo				
	61	Mesta	Mesta	Temenos				
	62	unknown in Creete		unknown				
11.Italy	63	Arno	Arno	S.Giovani alla Vena	8186		DCP	1972
	64	Ofanto	Ofanto	S.Manuele di Cafiero	2716		DCP	1930
	65	Pescara	Pescara	S.Theresa	3125		DCP	1936
	66	Po	Po	Pontelagoscuro	70091		DCP	1807
	67	Reno	Reno	Casalecchio	1051		DCP	1921
	68	Tevere	Tevere	Ripetta	16545		DCP	1925
	69	unknown						
	70	unknown in Sardegna						
	71	unknown in Sardegna						
	72	unknown in Sicili						
	73	unknown in Sicili						
	74	Spring of Stella						
12.Jordan	75	Wadi Zerqan	Wadi Zerqan	New Jerash Bridge			DCP DCP II	
	76	unknown						

13.Lebanon	77	Abou Samra	Abou Ali	Abou Samra	466	R		1965
	78	Awali	Awali	Embouchure	302	R		1949
	79	El Kebir-Arida	El Kebir	Arida	437	R		1939
	80	Ghzayel	Ghzayel	Route de Damas	150	R		1953
	81	Orante	Orante	Hermel	1241	G		1931
14.Malta	82			Marsa - Marsa			DCP	
	83			Marsalfom-Gozo			DCP	
15.Morocco	84	Moulouya	Moulouya	Dar el Carid	24422	R	DCP	1954
	85	mediterranean coast	Lao	Koudia Kourine	748	R	DCP	1970
	86	Tensift	N'Fis	Iguir N'Kouris	848	G	DCP II	1974
	87	Sebou	Ouergha	Ain Aicha	2453	G	DCP II	1981
	88	Oum-er-Rbia	Oum-er-Rbia	Tarhat	1026	R	DCP II	1975
16.Palestine	89	Wadi Gaza					DCP	
	90	Wadi Quilt					DCP	
17.Portugal	91	Tagus		Abrantes				
	92	Guadiana		Serpa				
	93	Algarve Eastern Basins		S. Brás de Alportel				
	94	Algarve Eastern Basins		Sta Catarina - Tavira				
	95	Algarve Eastern Basins		Lagos				
	96	Guadiana	Guadiana	Pulo do Lobo	60883			1945
	97	Alportel	Alportel	Bodega	132			1975
	98	Sado	Sado	Moinho da Gamitinha	2721			1933
	99	Tagus	Tagus	Tramagal	62348			1972
19.Slovenia	100	Soca	Baca	Baca pri Modreju	142	R	DCP II	1910
	101	Dragonja	Dragonja	Podkastel				
	102	Soca	Idrijca	Hotescek	442	R	DCP II	1840
	103	Notranjska Reka	Notranjska Reka	Cervenikov mlin	332	R	DCP	1951
	104	Soca	Soca	Kobarid			DCP	
20.Spain	105	Soca	Vipava	Miren -Cerkvnikov	593	R	DCP	1908
	106	Almanzora	Almanzora	Cantoria	1100	R		1991
	107	Ebro	Ebro	Tortosa	84230	R	DCP	1911

	108	Ebro	Ebro	Zaragoza	40434	R	DCP	1913
	109	Guadiaro	Guadiaro	S.Pablo Buceite	634	R		1991
	110	Jucar	Jucar	Alcala de Jucar	10785	R		1914
	111	Turia	Turia	La Presa	6294	R		1911
	112	unknown						
	113	unknown						
	114	unknown						
	115	unknown						
21.Tunisia	116	Zeroud	Hatab	Khanguet Zazia	2200	R	DCP	1956
	117	Nord Ichkeul	Joumine	Jebel Antra	234	R	DCP II	1952
	118	Mejerdah	Mejerdah	Bou Salem	16330	R	DCP II	1925
	119	Mejerdah	Mejerdah	Ghardimaou	1490	R	DCP	1946
	120	Oum Zessar	Oum Zessar	Koutine	276	R		1976
	121	Tessa	Tessa	Sidi Medien			DCP	
	122	Skhira	Skhira	Kef Labiath			DCP	
22.Turkey	123	Ceyhan	Ceyhan	Misis	20466	R	DCP	1970
	124	Filyos	Filyos	Derecikviran	13300	R	DCP	1963
	125	K. Menderes	K. Menderes	Selcuk	3255	R	DCP II	1952
	126	Meric	Meric	Kirishane	34990	R	DCP	1985
	127	Goliku	Goksu	Karahacili	10065	R	DCP	1961
	128	Gediz	Gediz	unknown			DCP II	
	129	egean coast	unknown	unknown				
	130	egean coast	unknown	unknown			DCP II	
	131	139-Spring (Taurus)	Dumanli				DCP II	
23.Yugoslavia	132	Danube	Danube	Bezdan	2628	R		1934
	133	Buna	Moraça	Podgorica		R	DCP II	
	134	Danube	Sava	Sremka-Mitrovica			DCP II	
	135	Danube	Velika Morava	Ljubičevski most			DCP II	
	136	Drini	Beli Drim	unknown			DCP II	
24.Israel	137							

	138							DCP II m
	139							
	140							
	141							
25.Lybia	142							-1
	143							DCP II m
	144							-3
	145							DCP II m
26.Syria	146	Barada and Awage	Awage	Om Sharitiet	261	R		1930
	147	Barada and Awage	Barada	Al Hameh	562	R		1931
	148	Barada and Awage	Barada	Tkiyed	164	R		1933

10. Annex 6 : Summary budget Phase II

Annual estimated Budget - in Euro

	2001	2002	2003	2004	Total
Pilot Regional Centre					
Staff, Office ¹	(100 000)				
Equipment	30 000				
Stays of NHS staff ²	176 000				
running cost	100 000				
DCP					
Purchase / Installation	300 000				
Maintenance ³	110 000 ³				
MHIS					
Development	125 000				
Data collecting and analysis ⁴	150 000				
Equipment ⁵	100 000				
Training courses	150 000				
<i>overheads 7 %</i>	<i>86 870</i>				
<i>Supervision WMO</i>	<i>80 000</i>				
Total	1 407 870 ³				

¹ contribution of IRD

² 22 000 E sponsorship per expert hosted in the Pilot Regional Centre

³ 2000 E per DCP, 35 DCP operating at the beginning, maintenance increasing 40 000 E per year

⁴ annual contribution to the NHSs of the participating countries for data collection, processing and dissemination costs

⁵ annual contribution to the NHSs of the participating countries for supply of electronic data processing equipment