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WMO - No. 1006

WMO and the PROMMA Project in Mexico

A success story



Technical assistance, training and transfer of technology for water management (1996-2005)

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Cover illustration: Above, Mexican hydrologists working in Los Salados, Guanajato State. Below, Aerial image of Novillero basin and Automatic Weather Station in the sunset (photos PROMMA).

NOTE
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BACKGROUND

The socio-economic growth of Mexico and the well being of its people have been closely tied to water resources availability and development. Considering the recent rapid growth in population and economic activity, as well as the increasing difficulties in developing new water resources –a large part of the country is either arid or semi-arid– Mexico will continue to be confronted with major critical challenges in the management of its water resources.

VISION FOR THE FUTURE

Mexico aspires to obtain: “ ... security in the allocation of the water resources needed for its development, that these resources be used in an efficient manner, its value recognized, the country’s water bodies protected and the environment preserved for the future generations”.

(National Water Programme)

To address some of these challenges, the Modernization of Water Resources Management Programme (Programa de Modernización del Manejo del Agua – PROMMA) of Mexico was conceived in 1994. Its main objective was to provide support to the Government in designing, developing, establishing and consolidating technical and administrative activities so as to enable the National Water Commission (Comisión Nacional del Agua - CNA) to comply with the provisions of the National Water Law of Mexico and its accompanying Regulations. The intention was to help the Government of Mexico improve its water resources policies, management capabilities and infrastructure as a contribution to environmentally sustainable socio-economic development in the country.

In 1994 the World Meteorological Organization (WMO) was invited to join the World Bank and the Government of Mexico in the preparation of the PROMMA Project proposal. Subsequently, through an Agreement signed in 1996, WMO participated in its implementation providing technical assistance, training and transfer of technology to the Mexican CNA.

The implementation plan for PROMMA covered initially the period 1996 to 2001. As a result of a World Bank Project Mid-term Review in early 1999 and the completion of the first PROMMA Technical Evaluation by WMO consultants (1998), the PROMMA activities were reprogrammed within a revised time horizon. Finally, PROMMA was concluded on 30 June 2005.

The panoramic synthesis that we present here shows that the inter-institutional collaborative approach in the conception, development and implementation of the PROMMA Project is certainly a good example of success story.



Lengthways and width of the arid regions the water for the population is often obtained from pumping stations (photo PROMMA).

PROMMA OBJECTIVES

PROMMA was conceived as an ambitious and far-reaching project, oriented towards the establishment and strengthening of the technical basis required for the sustainable development and management of the water resources in the country. Its primary objectives were formulated in terms of sustainability, efficiency, equity and integration, constituting an end point to be reached over the mid to long-term. The other objectives were the reference points settled to verify what has been achieved.

The project was intended to improve the knowledge about the available water resources in Mexico, from both quantity and quality points of view, and as part of the complete hydrological cycle, permitting consequently to improve the planning, administration and integrated management of water resources.

PROMMA primary objectives

- To promote conditions for environmentally sustainable, economically efficient and equitable allocated use of water resources in Mexico.
- To support integrated comprehensive management of water resources.
- To increase the benefits and reduce the risk related to existing hydraulic infrastructure.

Other objectives

- To support groundwater conservation by reducing overexploitation and contamination.
- To promote the restoration of surface water quality.
- Improve meteorological services for improved water management and for the society and the economy as a whole.
- To reduce flood damages downstream of reservoirs.
- Improve dam safety.
- To improve allocation of water as an economic good.
- To promote decentralization of water resources management through the establishment and strengthening of river basin councils

- To improve water resources planning through the development of the hydrographic region plans with river basin council participation

- To improve water rights administration through registry of water rights users and improved fee collection.

PROJECT IMPLEMENTATION AND COORDINATION

In view of its multidisciplinary and integrative nature, the activities of PROMMA were executed at national and regional level by a total of 50 CNA Units (Gerencias) working in different water-related disciplines pertaining to five General Sub-directorates of CNA.

The Technical General Sub-directorate (SGT) of CNA held the overall responsibility for PROMMA implementation and the Coordinating Unit established in 1996 had the general functions of supervising, monitoring and evaluating the project.

Under the agreement with CNA, WMO participated in the implementation of a number of multidisciplinary operational PROMMA components providing technical assistance, training and transfer of technology to the specific technical areas.

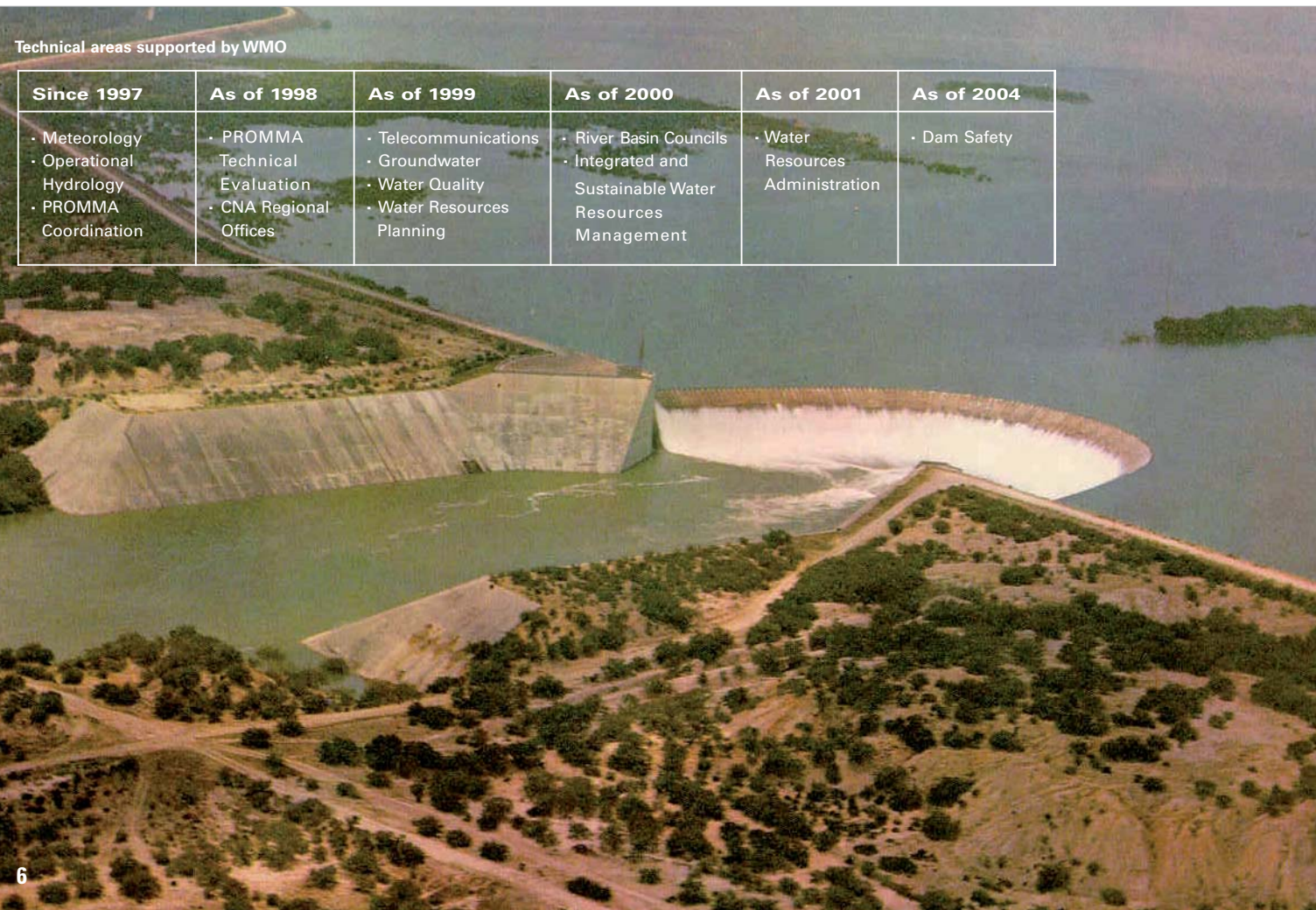


The sediment monitoring was a pilot project introduced for the first time in Mexico by PROMMA. The first measurements were undertaken in the Grijalva river basin in these sites of Chiapas and Tabasco (photo PROMMA).

Aerial view of the largest reservoir in the state of Tamaulipas, known as the "Presa Marte Gomez" in the San Juan Basin, Northern Mexico in the border with United States (photo PROMMA).

Technical areas supported by WMO

Since 1997	As of 1998	As of 1999	As of 2000	As of 2001	As of 2004
<ul style="list-style-type: none"> • Meteorology • Operational Hydrology • PROMMA Coordination 	<ul style="list-style-type: none"> • PROMMA Technical Evaluation • CNA Regional Offices 	<ul style="list-style-type: none"> • Telecommunications • Groundwater • Water Quality • Water Resources Planning 	<ul style="list-style-type: none"> • River Basin Councils • Integrated and Sustainable Water Resources Management 	<ul style="list-style-type: none"> • Water Resources Administration 	<ul style="list-style-type: none"> • Dam Safety



SUPPORT BY WMO TO PROMMA IMPLEMENTATION

From 1997 to 2004 the annual work programmes for PROMMA were prepared and agreed upon between the Mexican National Water Commission (CNA) and WMO.

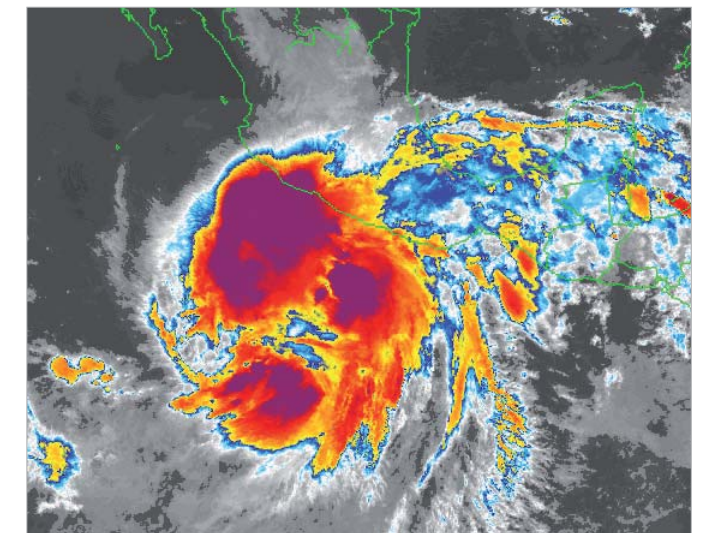
Specialized technical assistance services were provided through various Geneva-based WMO departments, during missions to Mexico at CNA headquarters and to regional offices by 216 international consultants, 124 national experts and 14 WMO staff -engaged from short to long-term duration whom, as required, also participated in training activities and in workshops and seminars.

The WMO support to PROMMA Coordination Unit involved assisting the planning, implementation and evaluation of activities within the Project; contributing to the formulation of specific documents related to the Project (including the preparation of terms of reference and technical specifications and facilitation of technology transfer between third party countries and Mexico); providing the required technical and logistical support and establishing the required arrangements for the participation of consultants and staff of WMO, for the undertaking of their duties, preparation of technical reports, and other activities required to ensure the Project implementation, namely training, technology transfer and supply of materials, specialized equipment and instruments, in accordance with WMO technical and administrative procedures.

Assistance was also provided through the direct procurement by WMO of specialized equipment required for the implementation of PROMMA, including 18 sediment monitoring samplers of different types; 2 different types of data collection platforms with meteorological, hydrological and water quality sensors for training purposes; 16 computers and three servers for the Hydroclimatological Information System (HIS); one workstation for the International Satellite Communications System as well as 2 scintillimeters to measure evapotranspiration.

Seven Annual Technical Evaluations of PROMMA were undertaken from 1998 to 2004 by a multidisciplinary team assembled by WMO. This team made an assessment of the progress of activities every year under the various components of PROMMA, and prepared recommendations for any corrective measures to be applied to improve the implementation of project activities.

The evaluations provided key advice and recommendations for the different specific areas, as well as elements for adjusting project objectives and activities as required, thus allowing the optimization of overall project implementation.



The meteorological information is crucial for an adequate management of water resources. Above, Hurricane approaching Mexico. Below, Automatic Weather Station of the Mexican network (photos PROMMA).





The agriculture is an important sector in the PROMMA approach for a sustainable management of water resources. The system of "plasticulture", permitting to avoid water waste, with controlled spreading irrigation, was promoted by PROMMA (photo PROMMA).

SOME HIGHLIGHTS OF PROMMA IMPLEMENTATION WITH WMO SUPPORT

Modernization of Hydroclimatological Monitoring

From 1998 until 2004, WMO experts prepared technical specifications for the new equipment to be installed and participated in the elaboration of international calls for tender and evaluation of bids. They also prepared, organized and participated in training courses for the installation, operation and maintenance of the new equipment procured.

The modernization was initiated in 1999, with the installation of 44 real-time data collection platforms and two satellite ground-receiving stations in the Rio Bravo basin which Mexico shares with the USA.

By the end of PROMMA, GASIR's telemetric network comprised 100 hydroclimatological stations at priority sites and three ground receiving stations completely installed and fully operational.

Re-design of Hydroclimatological Networks

The re-design was made from 1999 to 2004, comprising 39 priority river basins (28 groups of basins) and covering 62.4% of the national territory. WMO staff, with the assistance of international consultants, designed an operational strategy and methodology, based on a phased approach, with the direct participation of all stakeholders in the basin.

A total of 31 regional workshops were organized during the period, with over 400 people participating, including a number of local users.

The events provided unique opportunities to bring together the different parties involved, as well as to present the new developments in terms of operational hydrology and network re-design techniques. They also had an important technology transfer component.

Design and implementation of a modern Hydroclimatological Information System (HIS)

The Hydroclimatological Information System is, without doubt, a milestone resulting from PROMMA. It was developed jointly with the Mexican counterpart and with the participation of the CNA regional staff concerned at 13 CNA Regional and 20 State Offices and CNA headquarters.

This showed to be a very efficient technology transfer process.

By the end of 2004 an 80 % of timely transmission through Intranet of hydroclimatological information had been achieved from:

- 200 storage dams
- 250 hydrometric stations
- 1000 climatological stations

HIS contains the national historical hydroclimatological and storage dam data base.

Information is used for daily water-related operations and decision making, in normal conditions and during extreme events. 16 computers and three servers purchased through WMO were installed in Regional Offices for daily capture of hydroclimatological data and send it to the central databases in Mexico City.

For the development of HIS, a total of 35 training courses, workshops and presentations on HIS were organized by WMO consultants from 1999 with more than 300 participants.

In summary, HIS integrates: a distributed data base; a data administration system; a specific module for the capture and control of information; an information management system (client) allowing to visualize the information in tables, maps and graphic forms and to perform calculations; a web page in Intranet at the central level and in 13 regions; a module for the dissemination of the information to different places and exchange of information with other systems in CNA; and publication of reports in Excel through direct consultation of the data base.

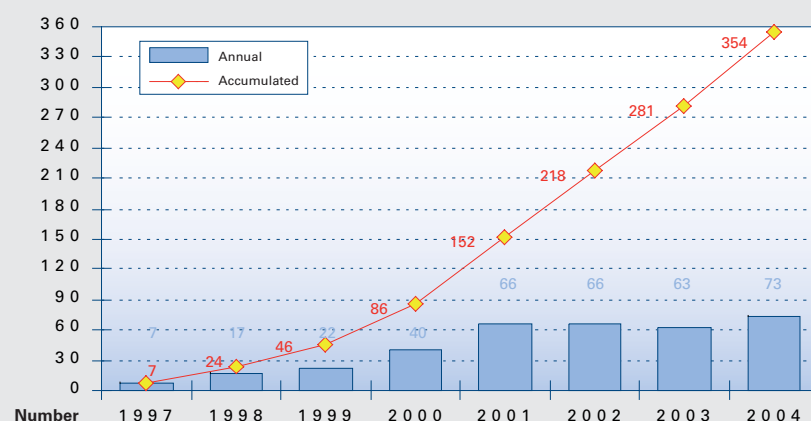
Pilot project on Sediment transport monitoring

The modernization of sediment monitoring was started by means of the establishment of a Pilot project on Sediment transport monitoring, comprising five pilot sites with modern measuring equipment in various river basins having different runoff conditions. This was the first time such type of a pilot project was undertaken in Mexico.

The equipment for the measurement of different types of situations was acquired through WMO.

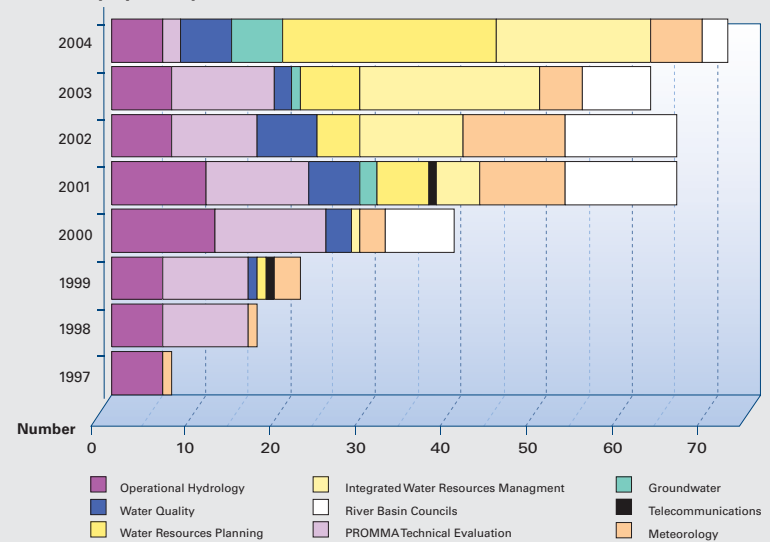
A sediment laboratory was established in the Grijalva river basin for the analysis and determination

Number of Consultants 1997 - 2004



The technical assistance services were provided by WMO to CNA by suitable WMO professional staff or by WMO consultants. In each case, the latter to be assigned were agreed jointly between CNA and WMO. The technical assistance services were carried out in accordance with WMO technical/administrative procedures.

Consultants by Speciality 1997 - 2004



During PROMMA implementation, a total of 354 consultants (216 international and 124 national experts, in addition to 14 WMO staff), were engaged from short to long-term duration to provide specialized technical assistance during missions to Mexico, in accordance with the annual approved work plans.

of suspended solids. This facility will also serve for the training of staff from other basins.

Starting in 2000 the first measurements were undertaken in the pilot sites in Chiapas and Tabasco (Grijalva river basin).

In 2003 the river engineering study of the lower Grijalva river was started, where the construction of a structure in the river was found to have negative impacts on sediment transport.

This was complemented by the preparation of catalogues of instruments, manuals and the organization of 10 events (seminars, workshops and training courses).

The activities of PROMMA in the field of sediment demonstrated the possibility of performing sediment transport measurements adapted to the sites and appropriate for the demand of data for projects showing the advantage and importance of the application of these data for different fluvial engineering projects.

Sustainable Management of Groundwater Resources (MASAS)

PROMMA was a decisive catalyst for the initiation, in 2001, of this multidisciplinary component on Sustainable Management of Groundwater Resources (MASAS). Through pilot projects for five overexploited aquifers, attempts have been made to define applicable strategies for the integrated and sustainable management of water resources.

The most significant results achieved were the "Study on the modernization strategy of the irrigation sector" and the "Strategies for groundwater management and action plans" for implementation at five over-exploited pilot aquifers [Aguascalientes (Ags), Celaya (Gto), San Luis Potosí (SLP), Hermosillo (Son) and Querétaro (Qro)].

The preparation of the five MASAS proposals was supported by an important number of multidisciplinary WMO consultants working mainly on location of the selected pilot basins and, very importantly, with the participation of local user groups of the aquifers areas involved.

Technical assistance was provided for:

- The design of the various elements of the projects.
- Training activities of both CNA staff and local users.
- The development of detailed plans of action and mechanisms to initiate the instrumentation of the project proposals.

MASAS constitutes the basis and has been the first step for the integrated and sustainable management of water resources in Mexico.

Experimental project to control salt water intrusion

An experimental project to control salt water intrusion for optimizing fresh groundwater withdrawals from the freshwater lens in the island of Cozumel (Yucatán) wellfield was developed by an international WMO consultant jointly with CNA staff during 2000-2001. Specific recommendations were then prepared to move to the operational phase.

Improvement of Meteorological Forecasts and Dissemination of Information to Users by the National Meteorological Service of Mexico

PROMMA also implied the technical modernization of the different networks that integrate the National Meteorological Observing System, as well as the telecommunications networks and the computer data base for the processing of the meteorological observations.

The project allowed the efficient technology transfer from NMSs of Argentina, Spain, the USA, the United Kingdom and from Environment Canada.

As a result, forecasts are put at the disposal of users and of the general public through the website of the mexican meteorological service, with more than 2.2 million users by 2004. The average of 5,000 daily visits of the site grows spectacularly when a hurricane threatens national coasts (over 65,000 visits in one day).

CAPACITY BUILDING AND TRAINING ACTIVITIES

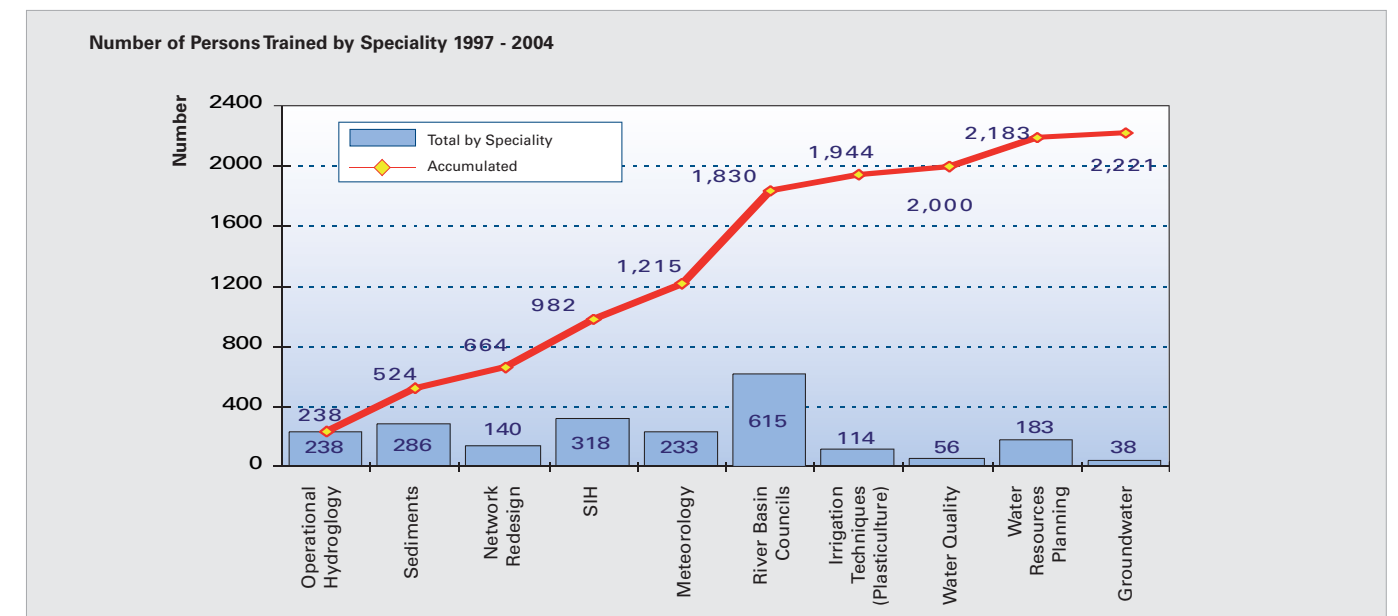
Significant efforts were made to undertake a large number of capacity building and training activities in the areas covered by PROMMA.

Extensive on-the-job training by four WMO international consultants was conducted, in operational meteorology practices; capacity building through courses in the field of radar meteorology, covering both meteorological (image interpretation) as well as mechanical and electronic maintenance and repair aspects; training in medium and long-term forecasting and the preparation and issuance of monthly rainfall forecasts on an annual basis; long-term training of 10 SMN staff members in a WMO Regional Training Center (Costa Rica). The training of human resources also required to undertake and supervise the various functions of the water resources management, both during project implementation and after its completion.

During the implementation period an overall total of 928 courses were delivered with WMO support (consultants, WMO training centres, etc.) and a total of 2,224 persons received training in different areas of activity.



The PROMMA project undertook an unprecedented number of training activities all over the Country in different specialities related to water management such as technical workshops, above, and practical seminars in the field, below (photos PROMMA).



WMO/PROMMA TECHNICAL REPORTS

The results of all the relevant technical assistance and training activities undertaken under PROMMA were documented in a series of technical and mission reports prepared by the WMO consultants involved. This WMO/PROMMA Technical Reports series cover the whole spectrum of technical activities undertaken during PROMMA implementation.

A total of 223 reports or group of reports were prepared by the end of 2004. The list and content of these reports can be consulted through the PROMMA web-page, prepared as part of the project. Copies can be obtained from the WMO Secretariat.



The Thalimedes sensors installed in river basins permit to measure the water level in an hourly basis (photo PROMMA).

Reports were prepared in several fields:

- 39 related to hydrology and climatology
- 37 related to meteorology
- 30 related to water quality
- 27 for River Basin Councils
- 25 for planning and administration
- 29 for integrated water resources management

Practical manuals were distributed on:

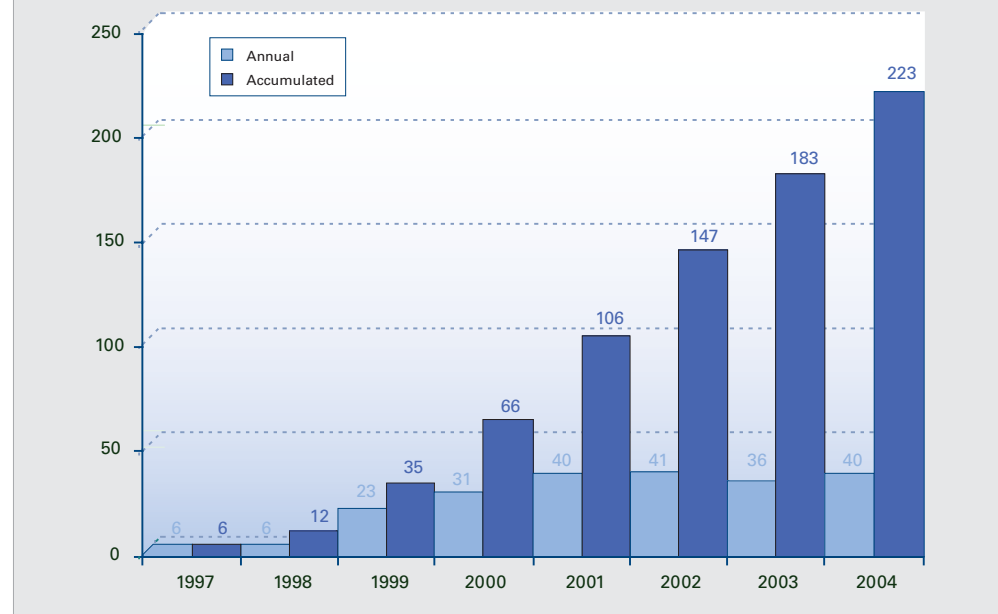
- Monitoring and inspection of climatological stations
- Sediment transport monitoring
- Climatological station observers (a poster)

Naturally, some of the WMO/PROMMA reports produced could be relevant to other Member countries, particularly Spanish-speaking countries.

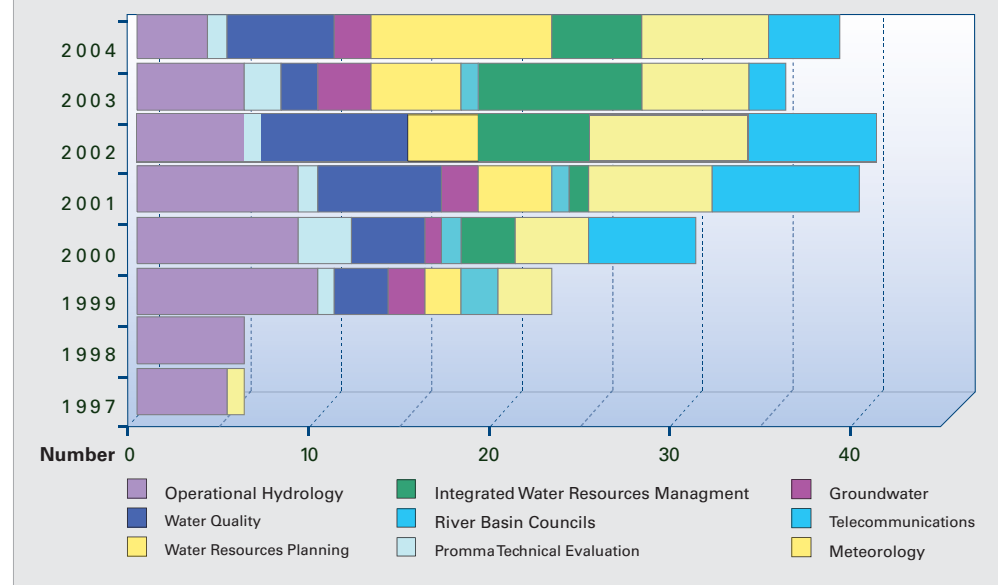


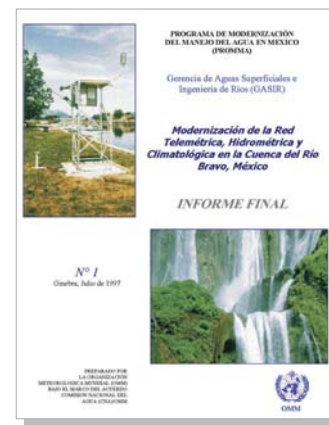
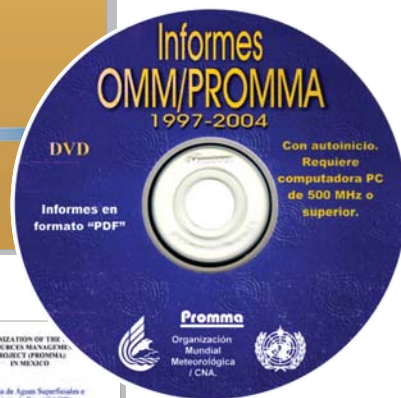
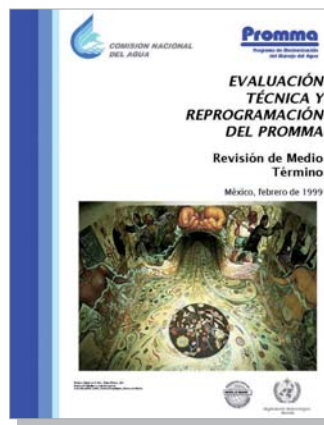
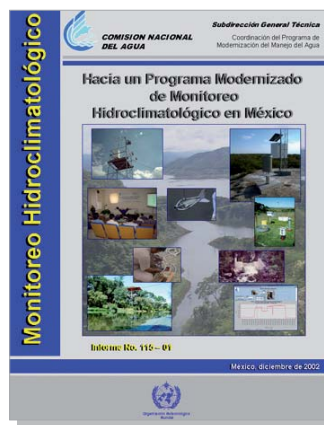
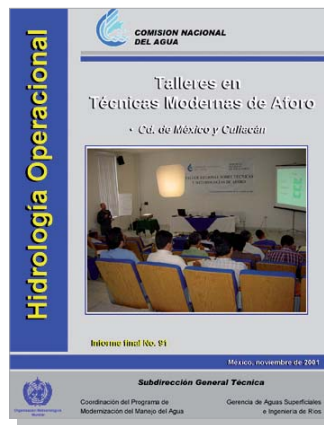
The irrigation system of "plasticulture" avoid the water waste and is recommended in PROMMA reports (photo PROMMA).

Number of Reports from 1997 - 2004



Reports Produced by Speciality 1997 - 2004





Copies can be obtained from WMO Secretariat.

CONCLUSION: MAIN ACHIEVEMENTS AND BENEFICIAL IMPACTS

PROMMA contributed to the attainment of significant and broad-based achievements across all sectors and programme components, which resulted from the multitude of actions and activities that took place over the period 1996-2005.

These activities permitted the modernization of observing networks for the monitoring of the water cycle; the re-design of the primary and secondary water quality national networks and the establishment of the national reference and regional water quality laboratories applying new technology for measuring and managing surface water, groundwater and water quality. All these progress were made having in mind that the maintenance, development and extension of the technical capacity and knowledge in Mexico needed to meet the development goals for the sector and fulfil the new role provided for by the recently modified National Water Law in issues such as water cycle monitoring, weather monitoring and forecasting, water rights administration, water resources planning and institutional development.

Although PROMMA has been concluded, the Implementation Completion Report of the CNA and the World Bank underlined that the Mexican Water Commission "... will continue seeking to meet Programme objectives, since these not only figure in the National Development Plan and hence in the

2001-2006 National Hydrological Plan, but have also become an integral part of the day-to-day activities working towards meeting institutional objectives. This is perhaps the most significant outcome of PROMMA, since implementation can continue, funded through national budgetary resources"

PROMMA had a total cost of USD 221.6 million (World Bank loan: USD 120.8 million and Government of Mexico funds: USD 100.8 million). WMO implemented USD 11.8 million (about 5.3%) of this total PROMMA delivery budget. PROMMA was successful in advancing towards its proposed long-term objectives of improving the conditions for a more equitable, efficient and sustainable use of the water resources in Mexico, supporting a participative and integrated management of the water resources, increasing the benefits and reducing the risks related to the existing water infrastructure.

The combination of the World Bank and WMO efforts in assisting a common Member in the formulation and implementation of such a large water resources project was unprecedented. Furthermore, the collaboration of WMO to this World Bank-funded project in one Member country has produced positive results becoming a showcase project, and opening possibilities for similar projects in other countries.



Benefits generated by PROMMA

- Support for decision making entailing economic and social repercussions.
- Mitigation of the effects of extraordinary hydrometeorological phenomena.
- Contributions to integrated and sustainable water management that take into account climatic variability and likely climate change.
- Support for decision making on administration and groundwater management issues.
- Support for decision making related to allocations and planning in the area of water management and pollution control.
- Support for decentralization of water management.
- Strengthening of water resource planning, both centrally and regionally.
- Support for rationalization of water use based on its economic value.