FOURTH
WMO LONG-TERM PLAN
1996-2005
SUMMARY OF OBJECTIVES, POLICIES AND STRATEGY
NOTE:
The designation and the presentation of material in this volume do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Meteorological Organization concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.
The World Meteorological Organization (WMO) has a proud history and an exciting future. Behind us we have more than 120 years of sustained international cooperation in a field of endeavour in which nothing less than a completely global approach is essential to ensure that all countries can benefit to the full from reliable weather and climate services. Ahead of us we have the formidable challenge of building and maintaining the global infrastructure — both the technology and the people — to underpin the two major thrusts of international meteorology into the early years of the 21st century: the continuation and strengthening of the vital ongoing services provided by national Meteorological Services to their national user communities, and effective contribution to the global objectives of sustainable development. This Fourth Long-term Plan provides a set of signposts, if not a detailed roadmap, to assist the Member countries of WMO to contribute effectively to the coordinated international effort in meteorology and operational hydrology and to benefit to the maximum from active participation in WMO programmes.

We are proud of our achievements so far in building the global meteorological infrastructure and the unique system of international cooperation which enables every nation to enjoy the benefits, at relatively small individual cost, of the entire global investment in the collection and provision of vital weather and climate information. In the 50th anniversary year of the United Nations, we achieved consensus, and ultimately unanimity, on an issue as complex as any that we have faced in the history of WMO — how to maintain our unique system of cooperation in data exchange in an increasingly competitive world and how to build a framework of interactions in which both the public good and commercial approaches to meteorology can coexist and prosper. Much of what Members' national Meteorological and Hydrological Services can contribute to the economic and social development of their countries over the next decade will depend on our success in maintaining this system of international cooperation which served us so well in the past.

The overall policy and strategy volume of the WMO Fourth Long-term Plan, of which this is the Executive Summary, is the work of the Members of the Organization. Through their participation in the sessions and activities of the WMO regional associations and technical commissions over the past four years, they have indicated their priority objectives and the way these should be achieved. The Twelfth World Meteorological Congress in 1995, which formally approved the Plan, made clear the importance it attaches to the efficient use of the available resources, especially those of the WMO regular budget, in helping achieve the
agreed objectives in support of human needs throughout the world. The Congress recognized that the achievement of these objectives will be a formidable challenge and one that will require very close cooperation within, between and beyond the meteorological, hydrological and oceanographic communities. We must clearly reach out and work closely with our sister agencies of the United Nations, and each of their counterparts at the national level, and especially with the non-governmental professional communities who share the goals and objectives of WMO.

I am pleased to commend this Plan to all the Member countries of WMO and to all those with an interest in the application of meteorology and operational hydrology in support of human needs and aspirations. I urge that every effort be made to ensure the achievement of the objectives set down in the Plan. I also invite WMO's sister agencies to join with us in a concerted effort to achieve our shared objectives for the next decade.

John W. Zillman
Weather and climate affect almost every aspect of human existence and endeavour. Modern science and technology provide the capability to monitor and predict the behaviour of the atmosphere, ocean and inland waters and enable national Meteorological and Hydrological Services to contribute to the safety, security and general welfare of their national communities. Through the World Meteorological Organization (WMO), working in collaboration with other international agencies, the nations of the world are engaged in an unprecedented partnership to monitor, understand, predict and protect the global environment in the interest of all humanity.

PURPOSES OF WMO

WMO was established to coordinate, standardize and improve world meteorological and related activities in aid of human endeavour. Its purposes, as set out in Article 2 of the WMO Convention, are:

- To facilitate worldwide cooperation in the establishment of networks of stations for the making of meteorological as well as hydrological and other geophysical observations related to meteorology, and to promote the establishment and maintenance of centres charged with the provision of meteorological and related services;
- To promote the establishment and maintenance of systems for the rapid exchange of meteorological and related information;
- To promote the standardization of meteorological and related observations and to ensure the uniform publication of observations and statistics;
- To further the application of meteorology to aviation, shipping, water problems, agriculture and other human activities;
- To promote activities in operational hydrology and to further close cooperation between Meteorological and Hydrological Services;
- To encourage research and training in meteorology and, as appropriate, in related fields and to assist in coordinating the international aspects of such research and training.

OVERALL OBJECTIVES

In carrying out the basic purposes as set out in the Convention, the overall objectives of WMO are:

- To achieve maximum benefits for all nations from the effective application of meteorological, hydrological and related environmental data, knowledge and services, in particular, for the protection of life and property and in support of national and international programmes for sustainable development;
- To provide an efficient mechanism for international cooperation in meteorology, including climatology, operational hydrology and related disciplines;
- To bridge the gap between the national Meteorological and Hydrological Services of the developed and developing countries;
- To anticipate the needs of future generations for reliable long-term historical records of meteorological, hydrological and related environmental information and to ensure the availability of such information;

THE WORLD METEOROLOGICAL ORGANIZATION

The World Meteorological Organization (WMO), whose Convention entered into force on 23 March 1950, is a United Nations specialized agency composed of 181 Members — 176 States and 5 territories*. WMO's predecessor, the non-governmental International Meteorological Organization (IMO), was founded in 1873.

WMO activities are carried out under seven major Programmes. The Organization has 246* regular staff posts. Its headquarters are in Geneva, Switzerland.

* on 31 December 1995
• To promote the understanding of atmospheric, hydrospheric and related earth system processes through effective national and international research programmes;
• To respond authoritatively to the increasing demand of the world community for expert advice on atmospheric and related issues of importance to countries;
• To provide an informed, authoritative and effective scientific voice for meteorology, including climatology, operational hydrology and related environmental sciences within the United Nations system;
• To contribute, through its involvement with global and regional issues which transcend national boundaries and affect all peoples, to the strengthening of international cooperation and goodwill between nations.

FIGURE 1. Structure of the World Meteorological Organization

WORLD METEOROLOGICAL CONGRESS

EXECUTIVE COUNCIL

Working groups, committees and panels of experts of the Executive Council

Other bodies which are affiliated with WMO, e.g. JSC for WCRP, Intergovernmental Panel on Climate Change, JSTC for GCOS

REGIONAL ASSOCIATIONS

(I) Africa
(II) Asia
(III) South America
(IV) North and Central America
(V) South-West Pacific
(VI) Europe

TECHNICAL COMMISSIONS

Basic Systems
Instruments and Methods of Observation
Hydrology
Atmospheric Sciences
Aeronautical Meteorology
Agricultural Meteorology
Marine Meteorology
Climatology

SECRETARY-GENERAL SECRETARIAT
THE ROLE OF WMO
1996-2005

Within the broad charter provided by its purpose and overall objectives, the role of WMO through the decade 1996-2005 will involve two separate but complementary major thrusts:

- Strengthening the established core activities and responsibilities of national Meteorological and Hydrological Services in support of the national needs and international obligations of Members;
- Harnessing the potential of meteorology and operational hydrology to contribute to endogenous capacity building and sustainable development within the framework of the United Nations Conference on the Environment and Development (UNCED) Agenda 21 and related international conventions and agreements such as those on the protection of the ozone layer, climate change, desertification and the sustainable development of Small Island States.

GENERAL POLICIES

In order to strengthen the core activities of national Services, WMO will:

- Actively assist Members to achieve fully the benefits of the operation of modern, well-equipped and adequately staffed national Meteorological and Hydrological Services, and to benefit also from international cooperation in meteorology, operational hydrology and related disciplines;
- Explore and develop all appropriate mechanisms for encouraging and facilitating the transfer of knowledge, technology and proven methodology between Members;
- Pay particular attention to the identification of probable future needs for long-term meteorological, hydrological and related environmental records on a worldwide and on a regional basis, both for purposes within its own areas of responsibility and to meet the future needs of other international agencies;
- Reinforce the principle and practice of free and unrestricted international exchange of meteorological data and products between national Meteorological (or Hydrometeorological) Services;

FIGURE 2: The WMO Regions
• Promote the active participation of Members in atmospheric and related research and development programmes, and in the exchange of meteorological expertise and technology;
• Place high priority on upgrading the effectiveness of the technical commissions in the overall coordinated planning and management of the scientific and technical programmes of the Organization;
• Assign an increasingly active role to regional associations in the planning and implementation of the scientific and technical programmes within their areas of responsibility.

In order to contribute towards sustainable development, WMO will:
• Enhance cooperative interaction between WMO and other international programmes in respect of the meteorological, hydrological and oceanographic contributions to sustainable development within the framework of Agenda 21 and associated international conventions and agreements;
• Promote awareness of the role of climate in influencing and limiting human development and thus of the importance of national Meteorological and Hydrological Services in the context of United Nations and other international and national programmes for sustainable development;
• Establish the timely delivery of its expert opinion on global and regional geophysical and geochemical issues to relevant international and national bodies and authorities as a high-priority activity;
• Enhance its contribution to monitoring, research and assessments related to the global environment through the work of the technical commissions and participation in collaborative global observational and research programmes;
• Increase its role in facilitating national capacity building in meteorology and operational hydrology;
• Enhance contributions to the objectives of economically and environmentally sustainable development;
• Further develop close partnerships with other International Organizations with complementary objectives, especially with the International Council of Scientific Unions (ICSU), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and its Intergovernmental Oceanographic Commission (IOC), and the United Nations Environment Programme (UNEP).

NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES

The primary purpose of all national Meteorological and Hydrological Services is to contribute to the economic and social benefit and welfare of their communities. Their most important function on a day-to-day basis is to provide weather and climate information, and forecasts and warnings of severe meteorological and hydrological events, and to ensure the assessment and forecasting of the quantity and quality of water resources. As the weather systems of the world are always interactive, no one country can be fully self-sufficient in providing for all of its meteorological services. The national networks of meteorological stations are integrated into a global weather and climate observing network. Thus, in carrying out their day-to-day functions in support of national economic and social activities, national Services serve both their own and the wider global community.

The most important function of national Meteorological and Hydrological Services in aiding longer-term planning activities and sustainable development is the collection, archiving, interpretation and application of climatological, hydrological and related information. This function is a rapidly growing part of the work of numerous national Services.
FIGURE 3. The operations of a national Meteorological Service: observations and data are processed and disseminated to specialized users.
MAJOR OBJECTIVES
1996-2005

The major objectives of WMO for the decade 1996-2005 are as follows:

Global observations
To foster the effective integration of global and regional programmes for comprehensive and reliable observation of the state of the global atmosphere and the entire earth system; and the free and unrestricted international exchange of these observations between national Meteorological and Hydrological Services.

Public services, welfare and safety
To ensure that all countries achieve better public understanding of the value of, and increased community benefit from, weather information, and improved weather and flood forecast and warning services provided by national Meteorological and Hydrological Services.

Natural disaster mitigation
To contribute to the goals of the International Decade for Natural Disaster Reduction (IDNDR) through the implementation of improved detection, prediction and warning systems as well as through the implementation of weather modification systems, aimed at safety of life and reduction of the social and economic impact of natural disasters.

Specialized meteorological and hydrological services
To assist Members to satisfy the requirements of the growing number of users of specialized meteorological and hydrological services and to give specific attention to transportation safety; provision of food, fibre and fresh water; land use planning; and energy production and use.

Climate
To ensure that WMO exerts effective international leadership in climate monitoring, research, and applications including global climate prediction, and provides an authoritative international scientific voice on matters related to climate and climate change.

Environmental quality
To contribute, through scientifically sound monitoring and research, to understanding, arresting and reversing the degradation of the atmosphere, the marine and hydrological environments and, using WMO capabilities, to provide effective warnings of impending environmental emergencies and disasters.

Sustainable development
To contribute, through meteorological, hydrological and oceanographic monitoring, research and prediction facilities and programmes of national Services, to environmentally and economically sustainable development in all countries.

Capacity building
To bridge the gap between national Meteorological and Hydrological Services of developing and developed countries through a coordinated strategic approach to assistance in preparing country plans, promoting public awareness, education and training and technical cooperation, as well as identifying possible funding mechanisms.

Commercial activities
To build an effective harmonious and mutually supportive relationship between the public and private sectors of the meteorological and hydrological communities in the provision of commercial meteorological and hydrological services.
The WMO strategy for achievement of these major objectives is based on harnessing the efforts of the global meteorological and hydrological community to meet present national and international needs and to support the implementation of Agenda 21 by:

- Collecting, managing and exchanging between Members the data, information, knowledge and expertise gained from current and future geophysical and chemical observing systems including World Weather Watch (WWW), the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and the Global Atmosphere Watch (GAW);
- Developing systematic procedures to monitor, evaluate and improve the WMO operational systems and programmes;
- Assisting national Meteorological and Hydrological Services to improve their ability to detect, predict and warn of severe weather conditions and floods, through cooperative research and technology and skills transfer;
- Producing and communicating, in particular through national Meteorological and Hydrological Services, assessments of the global climate and predictions of climate variations and change;
- Building on the existing WMO international frameworks for global data communication and processing, through collaborative research and applications activities with other international organizations;
- Enhancing WMO and national capabilities to monitor the atmospheric, hydrological and related geophysical environment, and provide information on, and warnings of, critical changes including the prediction of transboundary air pollution episodes;
- Increasing the capabilities of developing countries through the exchange of scientific and technological knowledge and the transfer of technologies, applications and operating systems;
- Assisting national Meteorological and Hydrological Services in establishing effective communication between the public and private sectors of the meteorological and operational hydrological communities.

The seven major Programmes of WMO focus on two principal needs: to improve meteorological and hydrological services worldwide through strengthening the core activities of national Meteorological and Hydrological Services, and to establish an improved scientific basis for, and contribution to, the implementation of Agenda 21 and the achievement of sustainable development. The Programmes include not only the provision of information and services but also the development and maintenance of the physical and human resources, and the knowledge needed, to support the provision of services.

The World Weather Watch is the core of the WMO programme. WWW combines observing systems, telecommunication facilities and data-processing centres — operated by Members — to make available meteorological and related geophysical information needed to provide efficient meteorological and hydrological services in all countries. WWW also includes a Tropical Cyclone Programme, in which more than 60 countries are involved, an Emergency Response Activities programme, the WMO Satellite Activities programme which helps to ensure the provision of satellite data and products to meet Member’s needs, and an Instruments and Methods of Observation Programme to promote standardization and development of meteorological and related observations. An increasingly important part of the World Weather Watch Programme provides support for developing international programmes related to global climate and other environmental issues, and to sustainable development, for example, the Global Climate Observing System, the Global Ocean Observing System, the Integrated Global Ocean Services System (IGOSS) and the Global Atmosphere Watch.
The World Climate Programme assists countries to apply climate information and knowledge for economic and social benefit, for the achievement of sustainable development and the implementation of Agenda 21 and associated instruments including The Climate Agenda — an integrating framework for international climate-related studies. Through internationally coordinated projects, it promotes the improvement of understanding of climate processes; the monitoring of climate variations and changes; exchange of climate applications and impact assessment methodologies; and the development of options for strategies to respond to climate variability and change. The World Climate Programme, as a whole, provides an authoritative international scientific voice on climate and climate change. A number of other climate-related programmes and activities, such as the Global Climate Observing System — a collaborative programme between WMO, the Intergovernmental Oceanographic Commission of UNESCO, UNEP, and the International Council of Scientific Unions — are also associated with the World Climate Programme.

The Atmospheric Research and Environment Programme promotes atmospheric research and development and technology transfer between Members. It includes the Global Atmosphere Watch, which integrates monitoring and research activities carried out under the Global Ozone Observing System (GO³OS) and the Background Air Pollution Monitoring Network (BAPMoN) and serves as a system to detect changes in the composition of the atmosphere, an important prerequisite to understanding human impact on the atmosphere and addressing important aspects of sustainable development. The Programme also includes weather prediction research; a Tropical Meteorology Research Programme relating to studies of monsoons, tropical cyclones, rain-producing tropical weather systems and droughts; and a programme on the physics and chemistry of clouds and weather modification.
PROGRAMME STRUCTURE OF WMO, 1996-2005

1. WORLD WEATHER WATCH PROGRAMME
   1.1 Global Observing System
   1.2 Global Telecommunication System
   1.3 Global Data-processing System
   1.4 WWW Data Management
   1.5 WWW System Support Activity, including Operational Information Service
   1.6 Instruments and Methods of Observation Programme
   1.7 WMO Satellite Activities
   1.8 Tropical Cyclone Programme
   1.9 Emergency Response Activities
   1.10 WMO Antarctic Activities

2. WORLD CLIMATE PROGRAMME
   2.1 Climate Programme Coordination and Support Activities
   2.2 Global Climate Observing System
   2.3 World Climate Data and Monitoring Programme
   2.4 World Climate Applications and Services Programme
   2.5 World Climate Impact Assessment and Response Strategies Programme
   2.6 World Climate Research Programme

3. ATMOSPHERIC RESEARCH AND ENVIRONMENT PROGRAMME
   3.1 Global Atmosphere Watch
   3.2 Programme on Very-short and Short-range Weather Prediction Research
   3.3 Programme on Medium- and Long-range Weather Prediction Research
   3.4 Tropical Meteorology Research Programme
   3.5 Programme on Physics and Chemistry of Clouds and Weather Modification Research

4. APPLICATIONS OF METEOROLOGY PROGRAMME
   4.1 Public Weather Services Programme
   4.2 Agricultural Meteorology Programme
   4.3 Aeronautical Meteorology Programme
   4.4 Marine Meteorology and Associated Oceanographic Activities Programme

5. HYDROLOGY AND WATER RESOURCES PROGRAMME
   5.1 Operational Hydrology Programme — Basic Systems
   5.2 Operational Hydrology Programme — Applications and Environment
   5.3 Programme on Water-related Issues

6. EDUCATION AND TRAINING PROGRAMME
   6.1 Manpower development
   6.2 Training activities
   6.3 Education and training fellowships
   6.4 Support to training events under other WMO major Programmes

7. TECHNICAL COOPERATION PROGRAMME
The Applications of Meteorology Programme comprises four vital areas of applications of meteorological services and information: public weather services, agricultural meteorology, aeronautical meteorology, and marine meteorology and associated oceanographic activities. The Programme promotes the development of infrastructures and services which enable the benefits from these applications to flow on to national and international economic and social activities.

The Hydrology and Water Resources Programme is concerned with the assessment of the quantity and quality of water resources in order to meet the needs of society, mitigating of water-related hazards and maintaining or enhancing the condition of the global environment. The Programme includes standardization of all aspects of hydrological observations, the organized transfer of hydrological techniques and methods, and is closely coordinated with UNESCO's International Hydrology Programme.

The Education and Training Programme provides the path to future progress by promoting all efforts in Member countries to ensuring that the necessary body of trained meteorologists, hydrologists, engineers, and technicians is available to carry out national and international programmes in meteorology and operational hydrology. Major thrusts of the Programme are directed towards capacity building for sustainable development and towards increasing capability in using the results of applications of new technology.

The Technical Cooperation Programme provides the vehicle for the organized transfer of meteorological and hydrological knowledge and proven methodology among Members of the Organization. Particular emphasis is placed on the development of a wide range of services (related to weather prediction, climatology and hydrology); on the development and operation of key World Weather Watch infrastructures; and on supporting the Education and Training Programme. There is a concentrated effort to support development that will contribute to capacity building as part of the implementation of Agenda 21. Funding for the Programme comes from a variety of sources including the United Nations Development Programme (UNDP), WMO's Voluntary Cooperation Programme (VCP), trust funds and the WMO regular budget.
IMPLEMENTATION

Resources to implement the Fourth WMO Long-term Plan and achieve the main long-term objectives of the WMO Programmes will be provided through:

- Members' own resources to implement, through national programmes, their own part of the internationally agreed WMO Programmes;
- The regular budget of WMO;
- Technical Cooperation (Voluntary Cooperation Programme, trust funds, UNDP, Global Environment Facility, bilateral aid, etc.);
- Contributions by Members and donor agencies to cooperative arrangements;
- Contributions of private sector services;
- Special, including voluntary, funds established to support particular programmes or parts of programmes.

Worldwide, substantial resources are committed at the national level, and through bilateral and multilateral arrangements, to the work of national Meteorological and Hydrological Services and to related research and development. The programme objectives of WMO are, for the most part, achieved through the national programmes of Members who operate the necessary observing, telecommunication and data-processing systems, provide meteorological and hydrological services to user communities and conduct related research and development programmes.

The regular budget of WMO supports the coordination and standardization of many of the activities of national Services including the efficient exchange of meteorological and related information between countries. It also supports the promotion of centres to provide services and further the application of meteorology and hydrology expertise for the benefit of human activities.

The maximum expenditure, within the regular budget, approved by the Twelfth Congress in 1995 to implement the Programmes during the first four years (1996-1999) of the Plan is SFR 255 million.

The extra-budgetary resources that are expected to become available to support specific components of programmes such as technical cooperation, education and training, improvement in the World Weather Watch, monitoring, research and development, capacity building for sustainable development and activities related to Agenda 21 amount to SFR 89.7 million.
**FIGURE 7. Breakdown of proposed expenditures within WMO’s major Programmes for the twelfth financial period, 1996-1999**

- Education and Training Programme: 12.2%
- Hydrology and Water Resources Programme: 8.9%
- Applications of Meteorology Programme: 10.9%
- Atmospheric Research and Environment Programme: 11.8%
- Regional Programme: 10.8%
- World Weather Watch Programme: 22.4%
- World Climate Programme: 20%
- Overall coordination and public information: 3%

---

**SOME ECONOMIC BENEFITS OF METEOROLOGICAL AND HYDROLOGICAL SERVICES**

- Successful weather forecasts in May 1994 in the Minsk region of Belarus allowed postponement of early vegetable planting and prevented damage estimated at US$ 1.5 million;
- Studies carried out in Canada demonstrated that US$ 1 000 invested in data collection and interpretation, for the design of the Nipawin Dam, resulted in US$ 1.5 million saved on the otherwise over-design of the spillways;
- A nationwide public survey carried out in China has shown that the total annual socio-economic benefits derived from public weather services can be estimated roughly at US$ 1 billion;
- In Israel, benefits from frost avoidance through a correct site selection of avocado plantation using the information available in the National Frost Atlas were estimated to be approximately US$ 1 million;
- Use of daily temperature forecasts for the region of Rostov (Russian Federation) permitted economic benefits of US$ 12 million for the heating season 1993-1994;
- In the United Kingdom, total benefits from using weather information for road maintenance and road transport were estimated to be £100 million a year. The direct benefit for the civil aviation sector has been assessed to be over £80 million a year, predominantly from route selection and fuel planning;
- Studies in the USA demonstrated that the value of improved seasonal weather forecasts to agriculture in the southeast part of the country alone is approximately US$ 145 million a year (i.e. 2-3 per cent of farmgate value of total production in the region).

Source: Results of the case studies presented at the International Conference on the Economic and Social Benefits of Meteorological and Hydrological Services, Geneva, 1994 (WMO publication TD-No. 630)
OTHER WMO PUBLICATIONS AND DOCUMENTS WHICH ELABORATE THE FOURTH LONG-TERM PLAN

TD/No. 701*  The World Climate Programme 1996-2005 — Fourth WMO Long-term Plan, Part II, Volume 2
TD/No. 703*  The WMO Applications of Meteorology Programme 1996-2005 — Fourth WMO Long-term Plan, Part II, Volume 4

* These technical documents are available on request as paper copies or in electronic format from the Secretariat of the World Meteorological Organization, P.O. Box 2300, CH-1211 Geneva 2, Switzerland.

ACRONYMS AND ABBREVIATIONS

BAPMoN  Background Air Pollution Monitoring Network (WMO)
FAO  Food and Agriculture Organization of the United Nations
GAW  Global Atmosphere Watch (WMO)
GCOS  Global Climate Observing System (WMO, IOC, UNEP, ICSU)
GEF  Global Environment Facility
GEMS  Global Environmental Monitoring System (UNEP)
GOOS  Global Ocean Observing System (IOC, WMO, UNEP, ICSU)
GO_2 OS  Global Ozone Observing System (WMO)
GTOS  Global Terrestrial Observing System (ICSU)
HDP  Human Dimensions of Global Environmental Change Programme
HWR  Hydrology and Water Resources Programme (WMO)
ICSU  International Council of Scientific Unions
IGBP  International Geosphere-Biosphere Programme (ICSU)
IGOSS  Integrated Global Ocean Services System (WMO and IOC)
IHP  International Hydrological Programme (UNESCO)
IMO  International Meteorological Organization (predecessor of WMO)
IOC  Intergovernmental Oceanographic Commission (of UNESCO)
IPCC  Intergovernmental Panel on Climate Change (WMO and UNEP)
UNCED  United Nations Conference on Environment and Development
UNDP  United Nations Development Programme
UNEP  United Nations Environment Programme
UNESCO  United Nations Educational, Scientific and Cultural Organization
WCP  World Climate Programme (WMO, FAO, IOC, UNEP, UNESCO, ICSU)
WHYCOS  World Hydrological Cycle Observing System (WMO, World Bank and UNESCO)
WMO  World Meteorological Organization
WWW  World Weather Watch (WMO)
FIGURE 8. Observing the weather and climate. This artist's impression shows the main meteorological observing systems which underpin the operation of the WMO World Weather Watch in the 1990s and which will provide the foundation for the Global Climate Observing System in the 21st century (Courtesy Australian Bureau of Meteorology)

1. Automated river-freight and rain gauges  
2. Automatic weather station  
3. Baseline air pollution station  
4. Meteorological observing station  
5. Meteorological satellite ground station  
6. Over-the-horizon radar  
7. Wind profiler  
8. Drifting Buoy  
9. Voluntary observing ship  
10. Domestic aircraft  
11. High-altitude research aircraft  
12. International aircraft  
13. Meteorological research aircraft  
14. Pilotless aircraft  
15. Radiosonde  
16. Geostationary meteorological satellite  
17. Polar-orbiting earth resources satellite  
18. Polar-orbiting meteorological satellite
Figure 9. The Regional Basic Synoptic Network of surface stations. At the heart of the WMO's World Weather Watch is the Global Observing System which includes about 10,000 land stations, 900 of which also make upper-air observations, some 7,000 ships and 600 drifting buoys. The World Weather Watch provides the basis for both operational weather forecasting and global monitoring of climate.

Figure 10. Polar-orbiting and geostationary meteorological satellites. WMO's role in the coordination of meteorological satellite activities as part of the World Weather Watch is aimed particularly at improving the capabilities of Members, especially developing countries, to use the data from space-based systems for providing more accurate and more timely weather services.
FIGURE 11. The Global Telecommunication System (GTS) of the World Weather Watch. The GTS enables rapid and reliable collection, exchange and distribution of meteorological and related observational data, analyses, forecasts and warnings between the national Meteorological Services of Members.

Prevention or alleviation of natural disasters such as, for example, topical cyclones is a major concern of the WMO. A significant amount of damage and loss of life is avoidable, given adequate forewarning of the characteristics and path of each cyclone. As population density and investment in cyclone-prone coastal areas expand, the detection, tracking, and prediction of tropical cyclones and forecasting of associated floods become increasingly important for many countries.
FIGURE 13. Public weather services in support of safety of life and property and for public welfare and convenience are a basic community necessity and right. Every day millions of people throughout the world listen to the radio, watch TV, read a newspaper, make a telephone call or send a written inquiry, to find out about the weather — past, present or future. Providing timely and reliable information to the general public on weather-, climate- and water-related events is a major function of the national Meteorological and Hydrological Services. This information not only saves lives and property, but also contributes to the economic and social development. Here Ms S. Charlton of the BBC presents the weather forecast on television (Courtesy BBC)

FIGURE 14. The Climate System. Much of our knowledge on climate comes from global scientific and technical programmes coordinated by WMO. The Organisation's mandate is also to coordinate and facilitate worldwide cooperation in making and exchanging standardized and quality-controlled meteorological, hydrological and related observations, as well as their analysis and interpretation.
FIGURE 15. Extreme climate anomalies and episodes during 1994 (Source: Climate Analysis Centre, NOAA, USA). Extreme weather and climate events cause havoc in many countries. Much of the knowledge on climate comes from the World Climate Programme and other global scientific and technical programmes coordinated by WMO.

FIGURE 16. The WMO’s Global Atmosphere Watch (GAW) stations and an indication of the average ozone distribution: low in the equatorial belt, high in the middle (and northern polar) latitudes. The GAW provides a scientific framework for the long-term monitoring of the state of the atmosphere as well as an early detection system for changes in the ozone layer, in atmospheric concentration of greenhouse gases, and in long-range transport of pollutants. The GAW enables WMO to provide authoritative scientific information and advice on the state of the global atmosphere in response to the increasing worldwide concern about the impact of human activities on the environment.
FIGURE 17. The World Hydrological Observing System (WHYCOS). The WHYCOS, which is being implemented by WMO and supported by the World Bank and UNESCO, has been designed to strengthen a global programme of water resources assessment.

FIGURE 18. Weather and climate information are essential for the sustainable development of agricultural activities. The challenge to obtain and use specific meteorological and related data for the purpose of aiding food production, storage and transport in an environmentally and economically sound way is one of the most important issues facing many national Meteorological and Hydrological Services. The WMO's Agricultural Meteorology Programme addresses the relevant parts of the UNCED Agenda 21 and helps national Services to implement follow-up activities (WMO/E. Gorre-Dale).
The need for trained specialists in the application of meteorology and hydrology to problems of sustainability, and the need to increase the capability of many national Meteorological and Hydrological Services to use effectively the results of WMO Programmes, remain acute in many countries.

The major thrust of the WMO's Education and Training Programme is directed towards increasing capability in using the results of applications of technology.

FIGURE 19. Location of the WMO's Regional Meteorological Training Centres (1-Algeria, 2-Angola, 3-Egypt, 4-Kenya, 5-Madagascar, 6.7-Niger, 8-Nigeria, 9-China, 10-India, 11-Iraq, 12-Islamic Republic of Iran, 13-Uzbekistan, 14-Argentina, 15-Brasil, 16-Venezuela, 17-Barbados, 18-Costa Rica, 19-Philippines, 20-Israel, 21-Italy, 22-Russian Federation). The need for trained specialists in the application of meteorology and hydrology to problems of sustainability, and the need to increase the capability of many national Meteorological and Hydrological Services to use effectively the results of WMO Programmes, remain acute in many countries.

FIGURE 20. Funding of the WMO's Technical Cooperation Programme. The Programme comprises the mainstream of organized transfer of technology and proven methodologies in meteorology, hydrology and related disciplines among Members of the Organization. Collaborative efforts to mobilize resources are needed to reduce the technological gap between the level of meteorological and hydrological services provided in developing and developed countries.