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EXCHANGE OF HYDROLOGICAL DATA AND PRODUCTS

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INTRODUCTION

The World Meteorological Congress, at its thirteenth session, in 1999, adopted Resolution 25 (Cg-XIII) on *Exchange of hydrological data and products*. This Resolution (Annex 1) expresses the adoption by the international community of:

> *"a stand of committing to broadening and enhancing, whenever possible, the free and unrestricted exchange of hydrological data and products, in consonance with the requirements of WMO's scientific and technical programmes".*

The international community recently has used other vehicles to express this same commitment to the principle of unrestricted exchange of water-related information. In the *Overall review and appraisal of implementation of Agenda 21* {paragraph 28 (f)}, the Nineteenth Special Session of the UN General Assembly agreed on the need to "*foster regional and international cooperation for (water-related) information dissemination and exchange through cooperative approaches among United Nations institutions…*". The 51st Session of the UN General Assembly adopted (A/RES/51/229) the Convention on the Law of Non-navigational Uses of International Watercourses. Article 9 of this Convention, entitled "Regular exchange of data and information", states:

> *1. Pursuant to article 8, watercourse States shall on a regular basis exchange readily available data and information on the condition of the water course, in particular that of a hydrological, meteorological, hydrogeological and ecological nature and related to the water quality as well as related forecasts.*
>
> *2. If a watercourse State is requested by another watercourse State to provide data or information that is not readily available, it shall employ its best efforts to comply with the request but may condition its compliance upon payment by the requesting State of the reasonable costs of collecting and where appropriate processing such data or information.*
>
> *3. Watercourse States shall employ their best efforts to collect and where appropriate to process data and information in a manner which facilitates its utilization by the other watercourse States to which it is communicated.*

Article 8 of the Convention, referred to in Article 9, states a "General obligation to cooperate":

> *1. Watercourse States shall cooperate on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection of an international watercourse.*

The WMO's Resolution 25, the two UN documents referred to above, and other statements made in recent international fora all provide a clear signal to national hydrological services that the international dissemination and exchange of water resources information is to be facilitated. In the end, of course, national practice will be constrained by national laws, policies, and interests. Nevertheless, it is the purpose of this technical note to provide guidance to national hydrological services, and other agencies with responsibilities in water information management, on the practical implementation of Resolution 25.

1. EXPLANATION OF DEFINITIONS

Resolution 25 refers to the *exchange* of hydrological data and products, which normally implies reciprocal arrangements. However, many countries – for example, the twenty or so south and west Pacific Island states – have little or no need for hydrological data and products from beyond their borders. They may, however, be perfectly willing to provide data for international research and other purposes. Such a one-way flow, better termed *transfer* rather than exchange, also must be considered in implementing Resolution 25, as is pointed out in footnote 2 thereof.

A major topic of debate has been the definition of the adjective "hydrological", as applied to data, products and information. In other words, the exact nature of data, products and information to be exchanged have not been clearly defined. The matter will be dealt with later. At the present stage the comprehensive scope of information referred to in the Convention on the Law of Non-navigational Uses of International Watercourses, Article 9, should be kept in mind.

2. REQUIREMENTS FOR HYDROLOGICAL DATA AND PRODUCTS, AND REQUIREMENTS FOR THEIR INTERNATIONAL EXCHANGE

To ensure the most effective and efficient use of scarce resources, the international exchange of water-related data and products must meet current and (reasonably) foreseeable future requirements and purposes. Resolution 25 (in "Further adopts" 1, 2, 3) identifies three types of requirements:

(1) "those hydrological data and products which are necessary for the provision of services in support of the protection of life and property and for the well-being of all nations" (shall be provided on a free and unrestricted basis);

(2) "additional hydrological data and products, where available, which are required to sustain programmes and projects of WMO, other UN agencies, ICSU and other organizations of equivalent status, related to operational hydrology and water resources research at the global, regional and national levels" (should also be provided, where available);

(3) "all hydrological data and products exchanged under the auspices of WMO, for the non-commercial activities of the research and education communities (should be provided, on a free and unrestricted basis).

To enlarge on what might be covered by these requirements, it might be helpful to summarize the principal uses of hydrological data and products. These include:

2.1: Real-time applications: forecasting and warning of floods, low flows and other extreme events

These applications are normally carried out on the scale of a river basin, drawing on real-time observations of rainfall, river/lake levels, streamflow, and other variables pertinent to the particular application. They are almost invariably the responsibility of governmental (national/federal or sub-national) agencies, and the necessary data acquisition and processing are carried out by those agencies. International cooperation is necessary in shared river basins, in particular for the management of events such as the spillage of toxic substances. International cooperation is commonly subject to sophisticated arrangements under the aegis of such bodies as the Rhine Commission. In some parts of the world, cooperation has proved difficult to achieve due to political reasons.

2.2: Real-time applications: project operation

Applications of this type include such projects as irrigation or hydro-electricity schemes, in which observations of reservoir inflows, streamflow, water quality and other pertinent variables are used to guide decision making. Such activities are normally in the hands of the project operator, which may be a national or sub-national government agency, a public utility, a private company, or a cooperative of users. Some aspects of operational hydrology may be contracted out to a specialist organization. Water projects are almost all national, rather than multi-national, in nature, and information requirements are dealt with at that scale.

2.3: Engineering design

Estimation of design parameters preferably requires long records of rainfall, streamflow and other hydrological variables, supplemented by the acquisition of additional data for the specific project. In the absence of long records, regional synthesis or modelling may draw on data from beyond the project area to increase confidence in estimates. Such work is largely done in the national context, although for the purposes of the design of a project on an internationally-shared river or aquifer, or immediately adjacent to a border, data from a neighbouring country may be desirable. Again, political considerations have a significant influence.

2.4: Hydrological and environmental science

There are a number of cases in support of which there is a growing international transfer of water-related information, under the aegis of entities such as the FRIEND groupings associated with the UNESCO International Hydrological Programme, the Global Runoff Data Centre, and GEWEX. With growing interest in the macro-modelling of hydrological and meteorological processes at the global scale, the scientific requirements for a wide range of water-related data types – ranging from precipitation to aquifer storage – similarly are expanding. Access to existing datasets plus the outputs of purpose designed global observation programmes are crucial to progress in the science of global change.

2.5: Monitoring trends in the global environment

International entities and instruments such as the Commission on Sustainable Development or the Framework Convention on Climate Change place growing demands on the international community for data that describe the status and trend of the environment and resources, at the national scale. Assembly of national data is essential for the provision of global syntheses, such as the *Comprehensive assessment of the freshwater resources of the world*. While gross quantities of available water and utilized water have commonly been considered, many other environmental indicators are being introduced to describe global environmental trends.

2.6: General comments

The greater part of operational hydrology (3.1, 3.2, 3.3 above) is carried out at the national level, within river basins, project areas (e.g. an irrigation district), or in the context of sub-national administrative entities. Except in some internationally shared river basins, it does not require the same degree of international regulation or international exchange of data that is essential for meteorological purposes. In those river basins, legal instruments normally provide clearly specified mechanisms for collaboration, including sharing of information (there are over 300 international treaties related to water management in shared river basins). On the other hand, scientific hydrology and international diplomacy (3.4 and 3.5 above) have an increasing but often imprecisely defined requirement for the

international exchange of data - particularly for research and monitoring programmes that consider variability and trends in the global atmosphere, climate and environment.

The preceding paragraphs summarize the various uses of hydrological data and identify, in general terms, those that probably require the international transfer of data. To make the foregoing discussion more concrete, a case study (Annex 3) describes arrangements for the international exchange of hydrological data in Hungary. Hungary is an extreme example of a continental country in which international information exchange is vital for effective water management. The case study indicates the range of applications, data types, and arrangements that could potentially exist.

3. TYPES OF DATA AND PRODUCTS TO BE TRANSFERRED

In international meteorology, the input data required for computer models of the atmosphere and other forecasting tools/methodologies have been precisely defined, and are catered for in the World Weather Watch. It is desirable that the exchange of hydrological data and products similarly should be arranged within the framework of clearly specified user requirements and intended applications. Given the diversity of hydrological users and applications, the requirements in international hydrology will need to be specified on a case by case or project basis, with data providers meeting requests for data exchange to the extent that they are able to. (Such an approach is implied in the Convention on the Law of Non-navigational Uses of International Watercourses, Article 9). A major implication is that the onus is on intending users to define their needs precisely and unambiguously, rather than on suppliers to attempt to meet or anticipate possible needs. In practice, this is how the international exchange and transfer of hydrological data have commonly been managed - within the context of international river basin management or international science programmes.

The hydrological community has not felt confident that it can define “necessary” or “required” hydrological data and products for the purposes of the Resolution, in the same way that meteorologists could define “essential” meteorological data and products for the purposes of WMO Resolution 40 on exchanging meteorological data. Several groups within the WMO Commission for Hydrology and Regional Associations have attempted to draft lists of data to be exchanged (for example, Table 2 in Annex 8). The table contained in Annex 2 offers some guidance in this regard by providing examples of the types of data which might be provided on a free and unrestricted basis in support of reducing the loss of life and property from natural disasters such as floods or droughts. However, this is neither generally applicable, nor is it sufficiently detailed to be taken as an authoritative statement of requirements.

Appropriately, therefore, Resolution 25 does not precisely define the types of data that are to be transferred to meet the requirements outlined in the preceding section. It, therefore, implicitly acknowledges the diverse requirements of data users in different circumstances, in terms of variables and parameters, measurement precision, frequency of observation, timeliness, and other data attributes. The WMO Technical Regulations, Volume III (Hydrology), chapter D.1.2, list the types of observations that <u>should</u> be made at hydrometric stations, climatological stations, and groundwater stations. Chapter D.1.3, section 3.1, also identifies the types of forecasts, warnings and advisories to be issued, and lists the basic hydrological observations involved. However, the lists of observations in the Technical Regulations are not easily matched with the three requirements identified in Resolution 25, and they are very general in scope. Moreover, they do not include the more novel types of data - such as those obtained from satellites - used in global research programmes such as GEWEX.

There are many current examples of the international exchange and transfer of hydrological data and information that could provide guidance on the types of data falling under the ambit of Resolution 25. These include several international scientific programmes, such as the FRIEND groups operating

under the auspices of the UNESCO International Hydrological Programme (Annex 4); the Global Runoff Data Centre (GRDC) operating under the auspices of WMO (Annex 5); and GEWEX, a component of the World Climate Research Programme (Annex 6). Some examples of data exchange in international river basins include: those rivers covered by the International Joint Commission (Canada and the USA: Annex 7); the Rhine River (Annex 8); the River Plate (Annex 9); and the Mekong River (Annex 10). These cover the full range of circumstances, from the industrialized, advanced countries that share the River Rhine to the predominantly agricultural, developing countries in the Mekong River basin. Experience from the above river basins shows that it is possible to effectively administer international exchanges of hydrological information when countries have a common interest in doing so.

The arrangements for information exchange covered by Annexes 3 to 10 provide examples of four of the five types of hydrological applications described in section 3. The omission is the requirement for information to monitor trends in the global environment. Since this is a relatively recent application, it is perhaps not surprising that formal multi-lateral arrangements – outside those established by the Framework Convention on Climate Change or the Commission on Sustainable Development – for data exchange have not been established yet.

Although not selected for this reason, the examples in Annexes 4 to 10 reflect considerable diversity – and, in each case, flexibility – in the types of hydrological data that are transferred. The GRDC (Annex 5) is perhaps the simplest, with a preference for mean daily discharge data to be transferred, for research and global resource assessment purposes. Data exchange in the case of the Souris River (Annex 7) originally was also quite specific, relating primarily to river flow data required to monitor the effects of dam operation. However, river forecasting requirements – and evolving technology – have led to the exchange of a much wider range of data types, including snowpack and soil moisture observations, as well as forecasts. Data assembled by the Mekong Committee (now Commission) comprise the range conventionally considered to be core requirements for operational hydrology and water resource design, with the aim of providing a comprehensive inventory of the resource in a river basin (Annex 10). The information requirements in the River Plate extend from real-time project operation, and to the management of water quality issues, and are accordingly extensive (Annex 9). GEWEX (Annex 6) and the International Commission for the Protection of the Rhine (Annex 8) have data requirements that go far beyond those conventionally included within the definition of operational hydrology, including areal estimates of soil moisture, and biological indicators of water quality. The various FRIEND groups also have differing – and evolving – data requirements that reflect the particular research concerns of the group (Annex 4).

The examples serve to emphasize the point already made, that the international transfer of hydrological data cannot be managed in a generic, multi-purpose fashion, but must be tailored to the specific requirements of the countries and organizations involved. Since these are evolving, often quite rapidly, the types of data to be transferred can also be expected to change with time.

Another feature of arrangements for data exchange, highlighted by the Annexes, relates to database management. A centralized database is the key aspect of the GRDC (Annex 5), and has been the strength of the Mekong Committee's work (Annex 10). On the other hand, several cooperative arrangements rely on the exchange of data among national databases. The GEWEX programmes (Annex 6) fully exploit the ability of the Internet to facilitate rapid data transfer among individual data centres.

4. POLICIES RELATING TO THE TRANSFER OF DATA AND PRODUCTS

Policies and practices related to data transfer, in the context of water management in an international river basin, are defined in treaties or other legal instruments that establish cooperation. These treaties are assigned to the secretariats of international organizations or other responsible bodies for implementation so that the principal purposes of the treaties can be achieved. It is difficult to provide generally applicable guidance, because of the diversity of political circumstances in different international river basins. Policies and practices in specific cases are likely to reflect diplomatic or legal rather than hydrological or scientific considerations, although Annexes 7 and 8 indicate the flexibility and effectiveness that is possible where countries wish or have a clear incentive to work together.

In the case of international scientific programmes, on the other hand, there is a significant convergence in policies and practice. This is heightened by the inter-linkages between different programmes, e.g. GEWEX (Annex 6) and GRDC (Annex 5). Resolution 25, in "Further adopts" (4) and (6), provides some guidance on the policy and practice of the international exchange of hydrological information, but to a lesser extent than was the case for meteorological data and products, particularly in Resolution 40, Annexes 3 and 4. Additional points of guidance are given in the following paragraphs, which draw on the policies referred to in Annexes 4-6, and the recommendations in Annex 8, Table 2. Suppliers, in particular, should assess the applicability of these guidelines/recommendations to their particular circumstances.

Suppliers

a. Suppliers should develop and maintain clear policies and procedures, agreed where necessary with other national organizations, for the exchange and transfer of data. These should include, *inter alia*, conditions on supply, charging regimes, arrangements for commercial use, restrictions on distribution to third parties, etc.
b. Suppliers should claim ownership of the copyright on the data and products that they supply.
c. Suppliers should issue an explicit disclaimer of responsibility for the consequences of any use made of data that they supply, particularly in respect of raw, real-time data which may not have passed through quality control processes.
d. Suppliers should, where relevant, liaise with other organizations that have data in the same locality, to ensure that there are no contradictions between their data.
e. Suppliers should specify to recipients (users or "data wholesalers" such as GRDC) any restrictions on (and/or charges for) the availability and use of data, and should obtain acceptance of those restrictions and/or charges by users, before supplying data.
f. Suppliers should make available to users metadata related to the data that they supply, particularly related to data quality and reliability. The WMO *Technical Regulations* Volume III, section D.1.1.5 lists basic metadata for hydrological observation stations.
g. Suppliers should monitor the resources, particularly staff time, required for handling data requests, and should ensure that they are able to accurately assess the costs of – and where necessary the appropriate charges for – data transfer.

Users

h. Users should be able to specify what kinds of data are required, and the format in which they are required. They should define their requirements for the attributes of data, including frequency of observation, acceptable amount of missing record, precision and accuracy, and also specify their requirements for metadata about observation sites. They should preferably be prepared to specify the uses to which the data are to be put. (Specifying intended use and quality attributes assists suppliers to supply appropriate data).

i. Users working on collaborative projects should harmonize their requests for data, to avoid duplication of requests.

j. Users should respect the priority rights of data suppliers, and preferably should co-operate with suppliers, leading to, for example, the joint publication of results. They should give due credit to the original suppliers of the data, at all stages of use and in all outputs (reports, publications, etc).

k. Users should provide in their outputs any metadata needed by others to locate the original data.

l. Users should provide copies of their outputs (reports, publications, etc) to data suppliers, and should provide constructive (both positive and/or negative) feedback (e.g. on data quality shortcomings).

m. Users, particularly when engaged in international research projects, should consider whether the scale of their data requirements would justify including proposed data suppliers as project partners or participants, rather than merely as suppliers.

n. Users, including educational and research users, should budget in their project estimates for the direct costs of data transfer, particularly if data are to be obtained from suppliers in developing countries.

o. Users must not transfer data to third parties or employ the data in commercial work, without the permission of the data supplier.

General

p. Standardization of terminology, use of words, presentation of data and products, etc should be sought, to ensure comparability.

Significant benefits have come from the development of policies for data transfer, although the effort that has gone into this exercise has been considerable. Some international scientific programmes find that national agencies are reluctant to make data available. (In some countries, there are provincial/state or regional agencies that are willing to provide data to international research projects, but are reluctant to do so to federal organizations, or commercial consultants). It appears that the Northern European FRIEND policy has given confidence to a large number of organizations to contribute to the European Water Archive, because they have some control over its use. In practice, it should be noted, FRIEND groups have been liberal in accepting new members, so that the majority of international data requests can be met by a user joining FRIEND and then proceeding with its intended research.

The comprehensive policy statement of the HKH-FRIEND has the advantage (potential, rather than actual, in view of the short time that the group has been established) of making absolutely clear the conditions under which data are provided, and the responsibilities of each participant. It is user-focused, and addresses a number of issues that are often neglected, such as provision of metadata, or quality assurance.

There can also be disadvantages of an explicit policy, although these can be avoided in practice where there is goodwill. In particular, restrictive elements of most policies on data access discourage the wholly free exchange of data.

A growing number of countries are making their hydrological data available via the Internet. Such developments do away with certain inherent problems in data collection, particularly in terms of duplication of effort, data quality, and the cumbersome updating procedures involved in maintaining special purpose archives. Perhaps more importantly, it also removes issues related to data access and use, since the decision effectively has been made that anyone able to access a database via the Internet is able also to use it for any intended purpose. There are, however, no current agreed international standards for the presentation of hydrological data on the Internet.

Annex 1

WORLD METEOROLOGICAL ORGANIZATION

Thirteenth WMO Congress, Geneva, May 1999

RESOLUTION 25 (Cg-XIII)

EXCHANGE OF HYDROLOGICAL DATA AND PRODUCTS

THE CONGRESS,

NOTING:

(1) Resolution 40 (Cg-XII) - WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities,

(2) The inclusion of dedicated observations of the climate system, including hydrological phenomena, as one of the four main thrusts of The Climate Agenda, which was endorsed by the Twelfth Congress,

(3) That Technical Regulation [D.1.1] 8.3.1(k), states that, in general, the routine functions of NHSs should include, inter alia, "making the data accessible to users, when, where and in the form they require" and that the Technical Regulations also contain a consolidated list of data and product requirements to support all WMO Programmes,

(4) That the nineteenth Special Session of the United Nations General Assembly agreed, in its overall review and appraisal of the implementation of Agenda 21, that there is an urgent need to "...foster regional and international cooperation for information dissemination and exchange through cooperative approaches among United Nations institutions, …" (A/RES/S-19/2, paragraph 34(f)),

(5) That the fifty-first session of the United Nations General Assembly adopted, by resolution 51/229, the Convention on the Law of the Non-navigational Uses of International Watercourses, Article 9 of which provides for "regular exchange of data and information",

(6) That the Intergovernmental Council of the International Hydrological Programme of UNESCO adopted at its twelfth session Resolution XII-4 which dealt with the exchange of hydrological data and information needed for research at the regional and international levels,

CONSIDERING:

(1) The significance attached by International Conference on Water and the Environment (ICWE) (Dublin, 1992) to extending the knowledge base on water and enhancing the capacity of water sector specialists to implement all aspects of integrated water resources management,

(2) The call of world leaders at the United Nations Conference on Environment and Development (UNCED)(Rio de Janeiro, 1992) for a significant strengthening of, and capacity building in, water resources assessment, for increasing global commitment to exchange scientific data and analyses and for promoting access to strengthened systematic observations,

(3) That the United Nations Commission on Sustainable Development (CSD) in its Decision 6/1 "Strategic Approaches to Freshwater Management" has strongly encouraged States to promote the exchange and dissemination of water-related data and information, and has recognized "the need for periodic assessments … for a global picture of the state of freshwater resources and potential problems",

(4) The call by the nineteenth Special Session of the United Nations General Assembly "for the highest priority to be given to the serious freshwater problems facing many regions, especially in the developing world" and the "urgent need … to strengthen the capability of Governments and international institutions to collect and manage information … and environmental data, in order to facilitate the integrated assessment and management of water resources",

(5) The requirements for full, open and prompt exchange of hydrological data and products in support of various international conventions, such as the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change, and the Convention to Combat Desertification,

(6) The requirement for the global exchange of hydrological information in support of scientific investigations of world importance such as those on global change and the global hydrological cycle, and as a contribution to relevant programmes and projects of WMO, other United Nations agencies, ICSU and other organizations of equivalent status,

(7) The opportunities for more efficient management of water resources and the need for cooperation in mitigating water-related hazards in transboundary river basins and their water bodies which depend on the international exchange of hydrological data and information,

(8) The increasing recognition through scientific and technical endeavours, such as GEWEX, of the importance of hydrological data and products in improving the understanding of meteorological processes and subsequently the accuracy of meteorological products,

RECOGNIZING:

(1) The responsibility of Members and their NHSs to provide for the security and well-being of the people of their countries, through mitigation of water-related hazards and sustainable management of water resources,

(2) The potential benefits of enhanced exchange of hydrological data and information within shared river basins and aquifers, based on agreements between the Members concerned,

(3) The continuing need for strengthening the capabilities of NHSs, particularly in developing countries,

(4) The right of Governments to choose the manner by which, and the extent to which, they make hydrological data and products available domestically and internationally,

(5) The right of Governments also to choose the extent to which they make available internationally data which are vital to national defense and security. Nevertheless, Members

shall cooperate in good faith with other Members with a view to providing as much data as possible under the circumstances,

(6) The requirement by some Members that their NHSs earn revenue from users, and/or adopt commercial practices in managing their businesses,

(7) The long-established provision of some hydrological products and services on a commercial basis and in a competitive environment, and the impacts, both positive and negative, associated with such arrangements,

ADOPTS a stand of committing to broadening and enhancing, whenever possible, the free and unrestricted international exchange of hydrological data and products, in consonance with the requirements for WMO's scientific and technical programmes;

FURTHER ADOPTS the following practice on the international exchange of hydrological information:

(1) Members shall provide on a free and unrestricted basis those hydrological data and products which are necessary for the provision of services in support of the protection of life and property and for the well-being of all peoples;

(2) Members should also provide additional hydrological data and products, where available, which are required to sustain programmes and projects of WMO, other United Nations agencies, ICSU and other organizations of equivalent status, related to operational hydrology and water resources research at the global, regional and national levels and, furthermore, to assist other Members in the provision of hydrological services in their countries;

(3) Members should provide to the research and education communities, for their non-commercial activities, free and unrestricted access to all hydrological data and products exchanged under the auspices of WMO;

(4) Respecting (2) and (3) above, Members may place conditions on the re-export, for commercial purposes, of these hydrological data and products, outside the receiving country or group of countries forming a single economic group;

(5) Members should make known to all Members, through the WMO Secretariat, those hydrological data and products which have such conditions as in (4) above;

(6) Members should make their best efforts to ensure that the conditions placed by the originator on the additional hydrological data and products are made known to initial and subsequent recipients;

(7) Members shall ensure that the exchange of hydrological data and products under this resolution is consistent with the application of Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities;

URGES Members, in respect of the operational and scientific use of hydrological data and products, to:

(1) Make their best efforts to implement the practice on the international exchange of hydrological data and products, as described in FURTHER ADOPTS (1) to (7);

(2) Assist other Members, to the extent possible, and as agreed upon, in developing their capacity to implement the practice described in FURTHER ADOPTS (1) to (7);

REQUESTS the Executive Council to:

(1) Invite the Commission for Hydrology to provide advice and assistance on technical aspects of the implementation of the practice on the international exchange of hydrological data and products;

(2) Keep the implementation of this resolution under review and report to Fourteenth Congress;

DECIDES to review the implementation of this resolution at Fourteenth Congress.

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Annex 2

EXAMPLES OF TYPES OF HYDROLOGICAL DATA, INFORMATION AND PRODUCTS WHICH MIGHT BE PROVIDED IN SUPPORT OF REDUCING LOSS OF LIFE AND PROPERTY

Data (for all available time intervals):

- Precipitation data*
- Stage and flow data*
- Reservoir inflow, pool levels and outflows*

Information and reports on:

- Dam breaks*
- Levee failure*
- Ice jam, mud flows, landslides*
- Toxic spill*
- Storm surge*

Products

Floods

- Hydrographs
- Flood travel times*
- Flood forecasts*
- Peak discharges (with an indication of their return intervals)
- Peak stage (with an indication of their return intervals)
- Times to peak

Droughts

- Hydrographs (recession limbs)*
- Droughts and low flow forecasts*
- Minimum discharges (with an indication of their return intervals)
- Minimum stage (with an indication of their return intervals)

* to be provided in real time

Annex 3

INTERNATIONAL EXCHANGE OF HYDROLOGICAL DATA: *HUNGARY*[1]

Introduction

Hungary is situated in the lower part of the Carpathian Basin. Owing to its geographical situation, more than 95% of the river flow originates from outside the country. Almost any operational hydrological activity requires data originating from outside the state borders. This emphasizes the importance of international hydrological data exchange for Hungary, in relation to neighbouring states and generally within the Danube basin, the most international river basin of the world. Despite its central location within the Danube basin, Hungary is predominantly a "downstream country", with over 20 major or medium sized transboundary rivers arriving in and three major rivers leaving its territory.

Data exchange policies

Different organizational and legal tools are used to regulate the exchange of hydrological data with neighbouring countries and countries of the Danube basin. These include:

- Bilateral or institutional cooperation and agreements: Austria, Croatia, Germany, Romania, Slovakia, Slovenia, Ukraine, Yugoslavia. Usually, agreements on transboundary rivers include articles on hydrometeorological data exchange.

- The WMO's WWW and GTS, disseminating meteorological data used also for hydrological purposes: In certain cases, SYNOP reports are extended with climate messages and data from snow reporting stations.

- Multilateral cooperation and agreements: the Danube Commission, Tisza Cooperation, Bucharest Declaration, Accidental Emergency Warning System.

- Meetings of hydrological services.

- Global Runoff Data Centre.

Data exchange to serve navigation is regulated by recommendations of the Danube Commission (Navigation, Belgrade Convention, 1948). Multilateral international operational data exchange during floods was established and further extended by Water Management of Tisza Countries and the Bucharest Declaration (1985). The latter included the development of international water quality monitoring. The Convention on Cooperation for Protection and Sustainable Use of the Danube River (1994) follows the earlier initiatives in an extended form. The Danube Strategic Action Plan is a principal result of the environmental programme. Several activities have direct relevance to hydrological data exchange, including the Trans-national Monitoring Network and the Accident Emergency Warning System.

The recently (1997) initiated informal meetings of the representatives of hydrological services in the Danube basin include countries with minor shares in the basin, and may serve as a tool to strengthen existing or establish new personal ties, and to extend cooperation beyond the frames defined by the above agreements.

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[1] Prepared by Dr O. Starosolszky, VITUKI, in October 1997.

Data Exchange

Daily exchange of data includes around 150 foreign hydrological stations reporting to Hungary, while data from 87 Hungarian stations is sent to neighbouring and other Danube countries. These messages usually include two gauge readings, often water temperature, synchronous air temperature and/or ice phenomena. Measured or calculated discharge values are also added. During flood events or water quality incidents, observation and reporting is more frequent, up to two-hourly. Data from 240 meteorological stations is received twice a day or more frequently, while observations from 40 stations are offered from Hungary for hydrological use, together with some weather radar observations in flood events. Over 300 snow measuring stations send their reports to Hungary, with a frequency of 4-7 days. Snow maps and calculated snow resources for Hungary and upstream parts of the Danube basin are offered to countries further downstream.

Bilateral cooperation with certain countries partly includes the exchange of groundwater and water quality data. Generally speaking, the exchange of this data is less frequent and regular than for surface water quantity data.

Regime information is exchanged through the exchange of hydrological yearbooks with those countries in which this type of publication exists, or via yearbook-type tabulations for stations in countries that do not compile yearbooks. Some data is offered for international publications and databases, like the yearbook of the Danube Commission, the Global Runoff Data Centre, and the FRIEND European Water Archive.

Annex 4

DATA EXCHANGE WITHIN THE FRAMEWORK OF THE IHP-FRIEND[2]

Policies and practice on data exchange

The FRIEND groups are autonomous, but have generally similar policies and practices on data exchange, often modeled on that developed by the Northern European FRIEND project. There have been extensive discussions about data issues and policies, which is reflected by the level of sophistication achieved in, for example, the HKH-FRIEND *Data and Information Plan* (see Table 1 below).

Northern European FRIEND

The Northern European FRIEND maintains a European Water Archive, through the Database Coordination Centre (Institute of Hydrology, UK) and five other regional data centres. The regional data centres are responsible for data acquisition, quality control, and transfer to the Database Coordination Centre. The Database Coordination Centre is responsible *inter alia* for maintaining the master version of the Archive, coordinating data acquisition, quality control, and supplying data to FRIEND research groups. Three conditions are applied to access to data on the European Water Archive:

a. Existing FRIEND participants are allowed free access, but use must be restricted to research in regional hydrology within the FRIEND project.
b. New participants must submit proposals for research to the project coordinator, subject to research topics being within the framework of the FRIEND project.
c. Data will not be released for use outside the FRIEND project unless written approval is given by both the relevant National IHP Committee and the data provider.

HKH-FRIEND (Hindu Kush-Himalaya FRIEND)

The HKH-FRIEND has been established to facilitate cooperative research in the areas of low flows, floods, snow and glacier hydrology, rainfall-runoff, and water quality. The Steering Committee has developed a comprehensive *Data and Information Plan*, which defines policies and practice in several areas (Table 1). A Data and Analysis Centre has been established, to support the work of the project groups.

Arrangements for data transfer from Data and Analysis Centre are similar to those for the Northern European FRIEND, with some conditions on data dissemination that are slightly more specific:

- Data will be released for use outside the HKH-FRIEND project under the following conditions:
  i) Data is available to users on a free and unrestricted basis, but requests for data must reach the Data Centre in a written form: letter; fax or email. (The request must specify the identity of the requester, exactly what is requested, the reason, the proposed use, and a summary of the research project).
  ii) The data user agrees in writing that the data received will not be transferred to third parties without the written consent of the Data Centre.

[2] The assistance of Alan Gustard (Institute of Hydrology, UK) is gratefully acknowledged.

iii) The data user agrees that the Data Centre may inform its members and other data providers concerned.
iv) The Data Centre makes available subsets of its database on request as stated above. Requests for the entire database or substantial parts of it cannot be entertained.
v) The costs associated with reproduction of the data may be charged.

There is also a disclaimer, to the effect that there may be errors in the data unknown to the Data Centre, and that neither it nor its sponsors can be held responsible for the consequences of the use of the data.

Table 1: Draft policies developed by HKH-FRIEND group

User requirements for data and information

- HKH-FRIEND datasets should be collected, developed and managed to meet the defined needs of HKH-FRIEND working groups;
- Data collection activities should follow on the basis of science and implementation plans of each working group;
- The Database group assembles a start-up or core-database which can be used by all or several of the working groups. The start-up database will contain basic datasets - i.e. on hydrological, meteorological variables, topographic information, topology of rivers - and eventually more GIS-related datasets - i.e. snow cover, land use and other spatial datasets.

Custodianship

- Data held in the RHDC or other national or institutional data-centres are owned by the data providers. As part of the end-to-end information management framework, all HKH-FRIEND datasets will have a designated data custodian.

Acquisition

- The Database Group is responsible for the acquisition of core data sets as defined above (i.e. hydrology, meteorology, spatial datasets) from national services, research organisations and other data providers. In addition, the HKH-FRIEND research groups complement the data acquisition with the collection of group specific data (such as snow cover and glacier mass information). The research groups may also generate new data sets in the course of their activities. These research data sets shall also be acquired by the RHDC and archived in the central database.

Access, dissemination and use

- HKH-FRIEND data and information should be made available in timely and unrestricted fashion at cost not exceeding the cost of reproduction and mailing.
- HKH-FRIEND data and information should be easily accessible in a variety of forms to meet the requirements of the user groups.

Metadata

- All HKH-FRIEND data and information must have directory level metadata
- All HKH-FRIEND datasets must have adequate metadata at the dataset level.

Data quality

All HKH-FRIEND datasets will be provided with adequate metadata, enabling users to assess quality in light of the intended use.

Data harmonisation

- HKH-FRIEND datasets should be harmonised to the extent possible to allow integration of national and institutional datasets into a usable regional information resource. This means in particular, that units of observation, data acquisition and transfer formats etc. should be harmonised as well as the quality and detail of information about datasets, Arial and spatial coverage of observations and other items

Archiving

- All HKH-FRIEND Data and Information must be safely archived along with all relevant metadata.

Annex 5

GLOBAL RUNOFF DATA CENTRE[3]

Introduction

The Global Runoff Data Centre (GRDC) operates under the auspices of the World Meteorological Organization (WMO), on the advice of its International Steering Committee and in cooperation with organizations such as UNESCO, UNEP, WHO and ICSU. A policy guideline has been prepared to regulate the acquisition and dissemination of hydrological data and costing of services. It does not infringe on the ownership rights of the data transmitted to the GRDC by data providers. In particular, the GRDC does not usually provide value-added and costed services to data users that fall in the domain of national hydrological services.

Principles for data acquisition and access

The GRDC operates under the principles laid down in Resolution 25 (Cg-XIII) of WMO Congress, with the aim of encouraging the widespread use of data for national, regional and global studies. Contributing countries are encouraged to transfer unrestricted, quality controlled, selected hydrological data together with station history information to the GRDC. The transfer of daily discharge data is preferred. When requested by a contributing agency, the GRDC also accepts and stores restricted data. In such cases, the agency concerned specifies the relevant restrictions and the GRDC flags the restricted data and uses them under the conditions specified by the contributing agency.

Dissemination of GRDC data

GRDC data is available to users under the principles laid down in Resolution 25 (Cg-XIII) and following the practice and disclaimer specified below:

- Requests for data should reach the GRDC in written form: letter, facsimile, telex or email.

- The data user agrees in writing to several conditions, including the condition that the data received is not transferred to third parties or used for commercial purposes without the written consent of the GRDC, that copies of outputs are provided to GRDC, that the source of data is cited, and that data will not be accessible to unauthorized persons.

- GRDC data shall not be used for commercial purposes without the prior consent of the national hydrological service(s) and/or other contributors of the data to the GRDC. The GRDC will request such consent on behalf of a potential user.

- The data user agrees that the GRDC may inform the national hydrological service(s) supplying the data about the uses to which their data has been put and will transfer the name and address of the data user to the hydrological service(s) concerned.

- The GRDC makes available subsets of the GRDC database on request. Requests for the entire database or substantial parts of it will be referred to the WMO Secretariat so that advice may be sought from CHy.

[3] See the GRDC policy guideline at http://www.bafg.de/grdc.htm

- Disclaimer: neither the GRDC nor the institutions providing the data, nor any of the institutions/agencies associated with the Centre can be held responsible for the consequences of the use of GRDC data, error free or otherwise.

Cost of GRDC services

The Guidelines include the following advice regarding the cost of GRDC services:

- Information about the GRDC, including the yearly status reports and the database contents (catalogue), are provided free of charge upon request.

- The GRDC charges data users on a non-profit base for the time used for carrying out services and for costs of material, handling and mailing.

- Standard GRDC services are free for agencies and institutions which contribute data to the GRDC, as well as for the secretariats of international organizations which are the principal clients of the GRDC, such as WMO, UNESCO, UNEP and WHO.

- For all other users, the cost for databank queries, diskettes, mail and all other overheads is based on the current price for services charged by the Federal Institute of Hydrology, Koblenz. For complex tasks where data products (statistical evaluations, graphics etc.) are also requested, a cost estimate is made and agreed upon in advance.

- Services for projects which require extensive work at the GRDC or the establishment of a specific database are agreed upon in a Memorandum of Understanding (MoU) between the project partners. In these cases, the financial contribution for the services of the GRDC are costed and incorporated in the MoU.

Annex 6

GLOBAL ENERGY AND WATER CYCLE EXPERIMENT

Introduction

The Global Energy and Water Cycle Experiment (GEWEX) is a programme initiated by the World Climate Research Programme to observe, understand and model the hydrological cycle and energy fluxes in the atmosphere, at land surface and in the upper oceans. GEWEX is an integrated program of research, observations, and science activities ultimately leading to the prediction of global and regional climate change. Its goal is to reproduce and predict, by means of suitable models, the variations of the global hydrological regime, its impact on atmospheric and surface dynamics, and variations in regional hydrological processes and water resources and their response to changes in the environment, such as the increase in greenhouse gases. GEWEX objectives are to:

- Determine the hydrological cycle and energy fluxes by means of global measurements of atmospheric and surface properties.
- Model the global hydrological cycle and its impact on the atmosphere, oceans and land surfaces.
- Develop the ability to predict the variations of global and regional hydrological processes and water resources, and their response to environmental change.
- Advance the development of observing techniques, data management, and assimilation systems for operational application to long-range weather forecasts, hydrology, and climate predictions.

Data sources

GEWEX is a collaborative endeavour that brings together many institutions, projects, and data collection exercises. Some of the data are already being generated for other purposes, and some are obtained specifically for a component of GEWEX. A major aspect of GEWEX is its role in facilitating access to datasets, and the Internet provides a key mechanism for locating data sources. Once located, data are transferred via Internet, CD-ROM, or other media, as appropriate.

The types of data transferred under the aegis of GEWEX and its components vary widely, depending on the thrust of the particular experiment. Surface water data, such as mean daily river discharges collected at discharge monitoring stations, are only one type. Meteorological, energy flux, and areal hydrological data (e.g. soil moisture) gathered using satellite sensors are strongly represented in the GEWEX data catalogue.

The data sources in the catalogue include both data originators and data centres. In the first case, for example, streamflow, lake level and sediment data for the Mackenzie GEWEX Study are available on CD-ROM from the Climate Information Branch of the Canadian Atmospheric Environment Service. In the second, the GRDC is a participating organization, and intending data users can obtain data from several originators, via the GRDC. In the case of BALTEX, the Swedish Meteorological and Hydrological Institute both is a data originator and acts as a regional data centre.

Policies and practice on data exchange

Considerable thought has gone into the development of policies and mechanisms for facilitating data access and exchange, with a focus on removing obstacles to free, unhindered availability. Within that overarching aim, the individual data providers have their own policies and practices. Thus, for example, the GRDC (see Annex 5) has developed its own policies, which are consistent with the aims of GEWEX, even though the GRDC exists independently of GEWEX. Another example is BALTEX, which is a component of GEWEX. BALTEX has a policy on data exchange (http://w3.gkss.de/baltex/exchange.html) that states:

> It is a prerequisite for the success of BALTEX to have an open approach to the exchange of all relevant information concerning the project. In particular, all data obtained from field experiments and process studies, as well as the codes and algorithms developed during BALTEX and the results of numerical experiments, should be available as freely as possible for non-commercial research purposes within the BALTEX scientific community.
>
> The storage of observational data as well as information about distributed data archives will be administered by appointed BALTEX Data Centers for meteorology, hydrology and oceanography. Their responsibility is the timely archiving and minimum-cost distribution of the information concerned. Whenever appropriate, data should be exchanged in real-time via existing networks.
>
> Priority rights of individual scientists should be properly respected. At the very least, appropriate reference to the source of data or information must be made. It is, however, strongly encouraged that the receiving scientist or group should co-operate with the originating scientist, leading e.g. to the joint publication of results.
>
> Data support from the national meteorological, hydrological and oceanographical services is of the greatest importance for a successful outcome of the BALTEX programme. The commercial rights of the involved agencies must be protected. In this context, a formal commitment of the Data Centers and the participating scientists in terms of the exclusively scientific utilization of data and results may be necessary.
>
> It is recommended that such a commitment should meet the following guidelines:
> - The data will be used only for research within the BALTEX scientific programme.
> - The data will not be passed on to a third party without permission from the data supplier.
> - The data will not be used for any commercial purposes.
> - The data supplier will be kept informed about scientific findings which are based on the delivered data.
> - Proper acknowledgement of the data source will be given in all publications based on the data.

Annex 7

THE INTERNATIONAL JOINT COMMISSION, CANADA AND THE UNITED STATES OF AMERICA

Role of the International Joint Commission

Many rivers and some of the largest lakes in the world lie along, or flow across, the border between the United States and Canada. The International Joint Commission assists the two governments in finding solutions to problems in these waters. The 1909 Boundary Waters Treaty established the Commission, which has six Members, three each from the United States and Canada. The Commissioners must follow the Treaty as they try to prevent or resolve disputes.

The various demands on the international rivers and lakes conflict from time to time. In some cases the International Joint Commission plays the role of authorizing uses while protecting competing interests in accordance with rules set out by the two governments in the Treaty. For example, the Commission may be called upon to approve applications for dams or canals in these waters. If it approves a project, the Commission can set conditions limiting water levels and flows, for example to protect shore properties and wetlands and the interests of farmers, shippers and others.

Much of the work of the Commission consists in assisting governments achieve their goal of cleaning up the Great Lakes and preventing further pollution in the system. In addition to the Great Lakes-St. Lawrence River system, the Commission assists governments in managing other waters along the border. It has continuing responsibilities in several areas. For example, in the west, the Commission has established conditions for dams on the Kootenay, Osoyoos and Columbia rivers, and has helped set rules for sharing the St. Mary and Milk Rivers. In the midwest the Commission sets emergency water levels for the Rainy Lake system, and has helped protect water quality in the Rainy River. In the east, the Commission plays a role in regulating dams on the St. Croix River, and in protecting the quality of the river.

An example of implementation: the Souris River

As a specific example of the work of the Commission, in 1940 it was requested to investigate and recommend on the regulation, use and flow of the Souris River and its tributaries, and the apportionment of the water between Canada and the United States. Measures for apportionment of the waters of the Souris River were recommended by the Commission in 1940 and 1959. These measures permitted Saskatchewan and North Dakota to divert, store and use waters originating in their respective portions of the basin - provided Saskatchewan did not diminish flows across the boundary by more than 50% of the natural flow and North Dakota delivered, as far as practicable, 20 cfs to Manitoba from June to October annually.

The International Souris River Board of Control was established in 1959 and was instructed to ensure compliance with the 1959 interim measures. The Board consists of six members (three from the U.S. and three from Canada) and reports annually, in the spring, on matters related to apportionment of the waters. The Rafferty and Alameda dams have an impact on the availability of water at the boundary. The Commission maintains continuous surveillance over the apportionment of the waters at the boundary through its International Souris River Board of Control. The Commission was requested in 1992 to monitor compliance with the measures, as modified by the 1989 Canada-U.S. Agreement for Water Supply and Flood Control in the Souris River Basin.

Twice a year, the International Souris River Board of Control meets to exchange data and information. The first meeting is to prepare for flooding in the coming snowmelt runoff season, and snow pack data,

other existing conditions and expected future conditions are reviewed. Based on expected conditions, expected reservoir releases in Canada, and their effects on North Dakota, are considered. During the season, the Saskatchewan Water Corporation sends reservoir release and stage data to the United States by fax and email, and there is also regular telephone contact to manage releases. During the second meeting, after the spring runoff season, events are reviewed.

Since the Souris River flows back into Manitoba, the US River Forecasting Center emails its forecasts for all forecast points and flow data for selected points to the Manitoba Water Resources Branch. Soil moisture, river stage/flow, snow water equivalent and other data are transferred, and there are regular telephone contacts. The Manitoba Water Resources Branch also emails its own forecasts and outlooks to the US RFC, for the Souris River.

There are similar arrangements for the Red River, particularly with respect to forecasting of river flows and levels during spring. Forecasts of flow peaks are exchanged regularly (several times each week) by phone between the US and Canada, along with data on hydrological and meteorological conditions. Automated email transmission of data files provide flow forecasts for 10 days in advance. Outside the spring snowmelt season, coordination continues when flows exceed certain trigger levels.

Annex 8

THE INTERNATIONAL COMMISSION FOR THE PROTECTION OF THE RHINE AND THE INTERNATIONAL COMMISSION FOR THE HYDROLOGY OF THE RHINE BASIN

Introduction

Various commissions are active in the catchment of the River Rhine. The most important are the International Commission for the Protection of the Rhine and the International Commission for the Hydrology of the Rhine Basin.

International Commission for the Protection of the Rhine

The "International Commission for the Protection of the Rhine against Pollution" (ICPR) was founded in Basel in 1950, at the instigation of the Netherlands, which was experiencing difficulty in providing potable drinking water. The Bern Convention on the International Commission for the Protection of the Rhine against Pollution was signed in 1963, as a basis for international law and cooperation, and in 1976 the European Economic Community became a contracting party. The Convention on the Protection of the Rhine against Chemical Pollution and the Convention on the Protection of the Rhine against Chloride Pollution additionally have been signed, in 1976, to provide a framework within which to deal with these particular issues.

Ministers from the participating countries define the tasks of the Commission. Its decisions are not legally binding, and implementation is the responsibility of the Member States. It works through a small secretariat, three permanent working groups (Water quality, Ecology, Emissions – see Table 1), two project groups (Sustainable development of the Rhine, Flood Defence), and expert groups assembled for specific tasks.

The key targets of the Commission are:

- Sustainable development of the entire Rhine ecosystem
- To guarantee the use of Rhine water for drinking water production
- Improvement of sediment quality in order to enable the use or disposal of dredged material without causing environmental harm.
- Overall flood prevention and environmentally sound flood protection
- Improvement of the quality of the waters of the North Sea

Two major action programmes are being implemented, the Rhine Action Programme (approved in 1987) and the Action Plan on Flood Defense (approved in 1998).

The main target of the Rhine Action Programme is to keep the Rhine ecosystem alive and in good health and to restore species that have disappeared. The return of salmon by the year 2000 is a visible mark of success of this programme. In order to reach this target, water quality must still be improved. Many actions to reduce nutrients and pollutants were necessary; some must still be carried out. These measures comply with the best available technology in production as well as in wastewater treatment.

Table 1: Principal tasks of the working groups

Working group A: Water quality

- Supervises the development of the quality of water, suspended matter and sediments and of residues in organisms.
- Evaluates the results of research programmes and develops these programmes.
- Assesses unusual concentrations of noxious substances with the help of chemical, physical and biological monitoring systems, including biotests.
- Evaluates monitoring results and reports on them.
- Periodically compares the state of the Rhine with the target values.

Working group B: Ecology

- Elaborates the Ecological Master Plan for the Rhine from the point of view of integrated ecological protection
- Drafts guidelines for a network of biotopes in the Rhine corridor and proposals for necessary measures.
- Supports the "Programme for the return of long-distance migratory fish to the Rhine – Salmon 2000"
- Supports and evaluates the success of control measures.

Working group C: Emissions

- Registers pollution sources and proposes appropriate reduction measures including, if necessary, economic incentives for point as well as non-point source emissions.
- Harmonizes the Best Available Technology for significant industrial sectors along the Rhine and monitors its application.
- Monitors measures for accident prevention and safety in industrial plants.

Water quality management requires monitoring, and, with a view to identifying the main sources of pollution and to assess whether the measures taken are successful, the ICPR operates an extensive monitoring system. Nine international monitoring stations from Reckingen in Switzerland to the three arms of the Rhine in the Netherlands continually record water data. In addition, some twenty further national measurement stations monitor the Rhine and its tributaries. Monitoring stations analyze over 200 different parameters, not only with respect to water, but - since the mid-eighties - also with respect to suspended matter and sediment, which can adsorb a major part of heavy metal and other contamination. Fish and other sensitive organisms play an important part in rapidly detecting pollution incidents. Analysts use "biotests" as early indicators of toxicants in the water. Subsequent chemical analysis enables them to identify the toxic substance, and thence its source. Water quality data are stored in the HYDBA-Water Quality database, published as tables, and made available via Internet. The data are available to all operational services within the Rhine catchment.

As contaminated water could still flow into the Rhine as a result of accidents, the ICPR has installed a warning and alarm system. Between Basel and the German-Dutch frontier there are six main international warning centres, and there are two more on the Moselle. In case of an accident, the warning centre concerned sends a "first report" to all centres downstream as well as to the ICPR secretariat in Koblenz. Normally, this report is only classified as "information", and a "warning" is only issued if water quality is seriously threatened. A recently developed computer-based alarm system enables the relevant authorities rapidly and reliably to predict the passage of a wave of pollution in the Rhine, and the expected contaminant concentrations.

The Action Plan on Flood Defence followed from the Declaration of Arles. In this Declaration, the EU Ministers of Environment affirmed that measures are required not only in the field of water

management, but also in the fields of spatial planning and land use, e.g. in connection with agriculture and forestry, nature protection, development of settlements and recreational use. The river basin commissions for the Rhine, the Sarre/Moselle and the Meuse were required to draft action plans on flood defence, which would incorporate measures in the field of spatial planning. In February 1995 the International Commission for the Protection of the Rhine (ICPR) commissioned the project group "Action Plan on Flood Defence" to draft an action plan for the Rhine and its catchment. The ecological improvement of the Rhine and its floodplains were to be integrated into and continued in this Action Plan. At the same time, parallel action was started for the Rivers Sarre/Moselle and Meuse. As far as spatial planning is concerned, the responsible Ministers in France, Germany, the Netherlands, Belgium and Luxembourg seized the opportunity of interdisciplinary and transboundary co-operation and set up a transnational working group "Spatial planning and preventive flood protection Rhine/Meuse". The European Union supported these activities within its initiative INTERREG II C.

The Convention for the Protection of the Rhine is the legal framework for flood forecasting, the exchange of hydrological and meteorological data for the development and operation of hydrological forecasting models, and the exchange of hydrological and meteorological products. *Hydrological data* includes primarily measurements of water levels of inland lakes and rivers, and discharge rates of rivers; *meteorological data* includes primarily measurements of precipitation, air temperature, measurements concerning snow-cover; and *products* include hydrological forecasts of water level and discharge rates, meteorological forecasts such as numerical forecasts, forecasts of snow-melt, and products related to precipitation obtained from satellite images and radar.

The contracting parties release their data and products and make them available to each other for use in exercises or operational use during flood events within the Rhine basin. Commercial use of data and products is prohibited, as is their transmission to third parties outside the agreement. A number of recommendations have been developed to regulate exchange of data and products within the scope of the Convention (Table 2).

Table 2: Recommendations for data and information exchange in the Rhine basin (Karl Hofius, personal communication, 1999)

Recommendations for the exchange of hydrological and meteorological data and products for operational forecasts

- Exchange of currently measured hydrological and meteorological data and products at a suitable temporal and spatial resolution, if possible in digital form.
- Availability of the required real-time data, centrally and electronically, by the respective national hydrological or meteorological service (as a first step).
- Medium-term provision of a central data base (e.g. virtual data base) with access to all data and products within the catchment of the river Rhine.
- Central collection of data within the Rhine river basin on a short-term basis (e.g. 30 days). This data should be made available to all member states.
- Agreement not to transmit data to third parties.
- No guarantee by originating services of the accuracy of real-time data and the availability
- (in space and time) of data and products.

Recommendations for the exchange of historical hydrological and meteorological data

- Exchange of historical hydrological and meteorological data at a suitable temporal and spatial resolution; if possible in digital form.
- Collection of data within the Rhine catchment and availability to all member states.
- Agreement not to transmit data to third parties.

Recommendations for co-operation between the forecasting centres

Cooperation concerns mainly the centres working on a supra-regional level and serves to prevent the distribution of contradictory statements. Principles include:

- Joint regulations on lay-out and structuring of flood warnings and forecasts in the media (videotext, internet, facsimile etc.)
- Standardization of terminology and use of words.
- Co-ordination of neighbouring centres to prevent contradictory statements.

Costs

For reciprocal data exchange no fees will be charged. The costs for data transfer will be settled by the concerned parties. A way to cover the costs for the installation and operation of a central data base for the entire Rhine catchment has to be worked out.

International Commission for the Hydrology of the Rhine Basin

This Commission was originally established within the framework of the International Hydrological Decade, and thereafter continued its activities within the framework of the International Hydrological Programme of UNESCO and the Operational Hydrology Programme of WMO. Its principal tasks are:

- To support cooperation between hydrological institutes and services
- To execute hydrological studies and exchange research results

- To promote the exchange of hydrological data and information, such as current data and forecasts
- To develop standardized methods for collecting and processing hydrological data in the riparian states

There is a permanent secretariat, and the Commission's work is conducted by rapporteurs and international working groups, with experts drawn from institutes, universities and national hydrological services in the participating countries (Austria, France, Germany, Luxembourg, Netherlands, Switzerland). Data and information exchange for joint projects is free and unrestricted. Permanent Representatives to the Commission from the participating countries meet twice a year to oversee activities.

The Commission has published (in 1978) a comprehensive monograph on the hydrology of the Rhine basin, and latterly has focussed on a number of research topics, such as:

- The influence of climatic change on the discharge of the Rhine
- Anthropogenic influences on the hydrological regime of the Rhine
- Development of an alarm model for the Rhine, which forecasts downstream movement of contaminants
- Sediment transport in the Rhine
- Ecological rehabilitation of floodplains

Annex 9

SISTEMA INSTITUCIONAL DE LA CUENCA DEL PLATA[4]

Los Gobiernos de Argentina, Bolivia, Brasil, Paraguay y Uruguay aprobaron los estatutos del Comité Intergubernamental Coordinador (CIC) en 1968. En 1969 los Gobiernos aprobaron el Tratado de la Cuenca del Plata, que entró en vigencia el 14 de agosto de 1970, para promover el desarrollo armónico y la integración física de la Cuenca y de sus áreas de influencia. El CIC es presidido en forma rotativa por los Representantes de los Estados miembros y cuenta con una Secretaría Ejecutiva, cuya sede está en Buenos Aires y funciona en forma permanente.

Las Unidades de Planificación Hídrica (UPH) son las siguientes:

UPH 110- Río Paraná Superior
UPH 120- Río Paraná Medio
UPH 130- Río Paraná Inferior
UPH 210- Río Paraguay Superior
UPH 220- Río Paraguay Medio e Inferior
UPH 310- Río Uruguay Superior
UPH 320- Río Uruguay Medio
UPH 330- Río Uruguay Inferior
UPH 400- Estuario del Río de la Plata

En 1973, en el área de recursos hídricos y referente al intercambio de datos hidrológicos y meteorológicos, se acordó en la declaración de Asunción sobre aprovechamientos de Ríos Internacionales lo siguiente:

- Los datos ya procesados serán objeto de divulgación e intercambio sistemático por medio de publicaciones
- Los datos a procesar, sean simples observaciones, lecturas o registros gráficos de instrumentos serán permutados o proporcionados a criterio de los países interesados

Los Estados miembros acordaron establecer contrapartes técnicas para considerar los temas incluidos en el plan de acción del CIC. Dentro de dicho plan se incluían actividades para confrontar los problemas de calidad del agua identificados en la cuenca y los problemas causados por las recurrentes inundaciones y desbordes de ríos, por lo cual fueron creadas las contrapartes técnicas denominadas "Calidad de agua" y "Alerta Hidrológico".

Desde la creación del CIC hace 30 años, en las reuniones anuales de cancilleres se han tratado temas que convergen al objetivo de establecer un sistema hidrológico y de monitoreo de calidad ambiental. En 1993 el CIC decidió promover el fortalecimiento de las actividades de monitoreo de la cantidad y calidad de las aguas, y una mayor integración de las respectivas instituciones encargadas de dichas tareas en cada uno de los países integrantes.

En 1996 el CIC recibió del Banco Interamericano de Desarrollo un Plan de Operaciones sobre Estudios para Calidad de Aguas, Alerta Hidrológico y Red Ambiental de la Cuenca del Plata, préstamo no reembolsable para realizar estudios de prefactibilidad por medio de consultores a fin de obtener un proyecto definido para el monitoreo de la calidad de los principales cuerpos de agua y para un sistema de alerta contra inundaciones o bajantes pronunciadas en tiempo real para la Cuenca del Plata y elaborar los términos de Referencia para los estudios de factibilidad y diseño.

[4] Prepared by A. Arcelus, Dirección Nacional de Hidrografía, Uruguay

Situación actual de redes fluviométricas

Con respecto a datos fluviométricos obtenidos en tiempo real, diferentes organismos poseen en la actualidad redes telemétricas operativas integradas por estaciones automáticas, habiéndose observado diferencias en cuanto al nivel de difusión de tales datos alcanzado. En efeccto, como se verá seguidamente, algunos organismos ponen la información en un sitio de Internet para que sea empleada sin restricciones por todo usuario mientras que otros generan datos para si mismos.

Red fluviométrica telemétrica de la Agencia Nacional de Energía Eléctrica (ANEEL)-Brasil

Nº de estaciones en operación
Son 150 estaciones con plataformas automáticas de recolección de datos con transmisión vía satélite cubriendo diferentes regiones del Brasil. Dentro de la Cuenca del Plata poseen 65 estaciones.
Datos registrados
Todas las estaciones registran niveles de ríos y precipitación con intervalo de interrogación de una hora. En la mayoría se efectúan mediciones de caudales líquidos y en menor proporción de caudales sólidos. En una cantidad significativa de estaciones se realiza muestreo para control de la calidad del agua.
Medio de recolección
Medio de telecomunicación: satélite de órbita ecuatorial SCD1. Si hay fallas se cuenta con el apoyo del satélite franco-americano ARGOS de órbita polar
Difusión
Los datos de niveles de río y precipitación son actualizados permanentemente y dispuestos en tiempo oportuno (cuasi-real) en la web: http://www.aneel.gob.br
Máxima demora: 6 horas
También se puede consultar datos horarios de los últimos 7 días en ftp://ftp.aneel.gov.br/pub/DADO

Red fluviométrica telemétrica de la Dirección Nacional de Vías Navegables (DNVN)-Argentina

Nº de estaciones en operación
Son 22 estaciones con plataformas automáticas de recolección de datos para
Datos registrados
Registro de niveles del Río Paraná y de la Plata
Medio de recolección
7 estaciones son interrogadas vía satélite INMARSAT C
15 estaciones, las más nuevas, son interrogadas vía telefonía celular
Difusión
La frecuencia de transmisión es una vez cada 3 horas y transmite las muestras tomadas en ese período.
Cabe mencionar que actualmente la información no es ni procesada ni almacenada, por lo cual esta red es de acceso limitado a los usuarios.

Red fluviométrica telemétrica de la Comisión Técnica Mixta de Salto Grande (CTMSG) –Argentina-Uruguay

Este organismo tiene a su cargo la explotación del aprovechamiento hidroeléctrico de Salto Grande sobre el río Uruguay.
Nº de estaciones en operación
Cuenta con red telemétrica de 51 estaciones con plataformas automáticas de recolección de datos. Toda esta red, de carácter específico para atender la operación del aprovechamiento hidroeléctrico cubre la cuenca intermedia del río Uruguay.

Datos registrados
Todas registran precipitación, 11 estaciones registran niveles de río, 2 registran otros parámetros meteorológicos.
Medio de recolección
La CTMSG transmite la altura del río mediante enlaces por VHF, para lo cual dispone de siete estaciones repetidoras.
Pluviometría: transmisión por eventos (mm de lluvias)
El disparador de las transmisiones es la cantidad de lluvia, con reportes por cada mm de lluvia caída
Fluviometría:transmisión por eventos (por cm de variación) o por tiempo. Envía transmisiones cada 2 cm de variación o a intervalos regulares de 30 minutos
Difusión
Los datos son procesados por la CTMSG y no son difundidos ni publicados. Esta red es de carácter específico para atender la operación del aprovechamiento hidroeléctrico. La finalidad de la misma es de efectuar pronósticos de comportamiento del río Uruguay, en la medida que influye sobre su accionar operativo y comercial.

Red fluviométrica telemétrica del Servicio de Hidrografía Naval de Argentina

La finalidad es poder elaborar pronósticos de niveles del estuario del Río de la Plata.
Nº de estaciones en operación
En operación son 4 estaciones automáticas
Datos registrados
Tres de ellas generan datos horarios de niveles para navegación por el Río de la Plata
Medio de recolección
Tres de ellas son interrogadas mediante enlaces en VHF
Difusión
Los datos son procesados en oficina central a partir de los cuales se emiten pronósticos hidrológicos con informes cada 6 a 8 horas y alertas hidrológicos si se preve la ocurrencia de niveles extremos.

Red fluviométrica convencional de la Subsecretaría de Recursos Hídricos de Argentina

Nº de estaciones en operación
En operación son 26 estaciones en la Cuenca del Plata
Datos registrados
20 estaciones registran niveles de ríos y se efectúan mideciones de cuadales líquidos y sólidos, precipitación, y de otros parámetros meteorológicos según el sitio que se trate.
Las otras 6 son de observación directa de niveles.
Medio de recolección
Difusión
La Información es difundida con frecuencia diaria en época normal y a intervalos menores en época de crecidas por medio de equipos radioeléctricos de Banda Lateral Unica o del sistema telefónico

Red fluviométrica convencional de la DNVN Argentina

Nº de estaciones en operación
Operan 35 estaciones en la Cuenca del Plata fuera de la red telemétrica descripta anteriormente.
Datos registrados
Medio de recolección
Difusión
La información es difundida con frecuencia diaria en época normal y a intervalos menores en épocas de crecidas, por medio de equipos radioeléctricos de Banda Lateral Unica o del sistema telefónico.

Red fluviométrica convencional de la Administración Nacional de Navegación y Puertos de Paraguay

Nº de estaciones en operación
Opera 21 estaciones fluviométricas con destino a la navegación del río Paraguay.
Datos registrados
Medio de recolección
Difusión
Información difundida con frecuencia diaria por medio de equipos radioeléctricos de Banda Lateral Unica o del sistema telefónico

Red fluviométrica convencional del Servicio Nacional de Meteorología e Hidrología de Bolivia

Nº de estaciones en operación
Opera 1 estación
Datos registrados
Se miden niveles además de caudales líquidos y sólidos
Medio de recolección
Difusión
En épocas de crecidas se difunde la información sobre niveles a los restantes organismos de Paraguay y Argentina

Red fluviométrica convencional de la Dirección de Recursos Hídricos de la Provincia de Formosa-Argentina

Nº de estaciones en operación
Opera 4 estaciones convencionales
Datos registrados
Se miden niveles
Medio de recolección
Difusión
La información es difundida diariamente con destino a la Comisión Regional del Río Bermejo.

Red fluviométrica convencional de la DNH-Uruguay

Nº de estaciones en operación
Se operana 10 estaciones
Datos registrados

Medio de recolección
Difusión
Se difunde la información de 4 de las estaciones a los demás países integrantes del CIC vía e-mail diariamente, y a intervalos menores en épocas de crecidas.

Red fluviométrica convencional del Servicio de Hidrografía Naval de Argentina

Nº de estaciones en operación
Operan 2 estaciones sobre el Río de la Plata

Datos registrados
Niveles del río

Medio de recolección
Difusión

Se adjunta vía fax listado de las estaciones fluviométricas recopiladas agrupadas por cada una de las subcuencas principales, acompañadas de su ubicación (latitud y longitud) seguido de el o los organismos responsables de la operación y mantenimiento de las instalaciones así como de la generación y difusión primaria de los datos.

Modalidades empleadas en la actualidad para el intercambio de datos hidrológicos

En la actualidad se realiza un intercambio de datos diarios a través de correo electrónico y además existen en la cuenca dominios virtuales que suministran información en tiempo real.

Desde comienzos de 1997 ANEEL de Brasil difunde mediante su página web (www.aneel.gob.br) los datos fluvio-pluviométricos horarios en tiempo real provenientes de su red telemétrica, constituyendo por ahora el único organismo que implementó este tipo de difusión masiva e irrestricta de información.

La Administración Nacional de Navegación y Puertos de Paraguay en fase experimental posee una página web (www.un.py/annp-gnh) con las informaciones hidrológicas de la Cuenca Media del río Paraguay.

El Servicio Meteorológico Nacional de Argentina comunicó en enero de 1998 que la información meteorológica e hidrológica diaria que recolecta puede observarse en su página web (www.meteofa.mil.ar)

En la mayoría de los restantes casos, los datos primarios son difundidos por medio de enlaces radioeléctricos y por vía telefónica. El resto de la difusión de la información se intercambia entre organismos usuarios mediante el envío de comunicaciones escritas transmitidas por fax y más recientemente vía e-mail vía internet.

Informe sobre el grado de radarización existente

Solamente en la parte brasileña de la cuenca se cuenta en forma operativa con radares meteorológicos aplicados a la previsión de precipitaciones a corto plazo, los que están asociados con redes telemétricas de pluviometría y fluviografía. La ubicación de los radares es la siguiente: Sao Paulo, Bauru, Presidente Prudente, Iraty y Fraburgo.

Calidad de agua

Las estaciones de la red actual de monitoreo en su mayoría no están operando, principalmente por motivos presupuestales. Incluso las estaciones cuyas entidades operativas dicen que las están operando, no realizan los análisis de todos los parámetros acordados por los miembros del CIC y no operan en forma continua.

Los organismos que controlan las estaciones de monitoreo de CIC, no han logrado atender los acuerdos en lo referente a la frecuencia de recolección y parámetros de calidad del agua. Se verificó que, incluso en las estaciones que están operando satisfactoriamente, hay un período muy amplio entre la recolección, el análisis, el almacenamiento y la divulgación de los datos. Los datos de calidad obtenidos hasta diciembre de 1997 no denuncian zonas de riesgo debido a que pocas estaciones estaban operando satisfactoriamente y los pocos datos publicados o disponibles estaban desactualizados y fueron recogidos en diferentes fechas, sin seguir la recolección trimestral acordada por los gobiernos de los países miembros.

No hay publicación esporádica o continua de los datos, excepto por la Compañía de Tecnología de Saneamiento Ambiental de San Pablo (CETESB/SP). En varios organismos gubernamentales, los datos sólo se liberan luego de intensas negociaciones. ANEEL está planificando poner todos los datos de calidad del agua en INTERNET, a ejemplo de lo que se realiza con los datos hidrológicos.

Los países miembros del CIC, cuentan con excelentes laboratorios de análisis y con técnicos calificados para realizar el muestreo y la preservación de las muestras pero no siempre en número suficiente para atender todas las solicitudes de sus poblaciones. Por este motivo, los acuerdos internacionales no siempre son prioritarios frente a las demás necesidades nacionales.

Diagnóstico de las Redes Existentes de Monitoreo de Calidad de Aguas Superficiales

Por el pequeño número de estaciones en operación satisfactoria, es imposible confeccionar mapas temáticos precisos, ya que debido a la gran distancia entre ellas, se pierde toda la información intermedia. A veces. la distancia entre dos estaciones próximas es de 400 km, por ejemplo entre Rosario y Buenos Aires, impidiendo que mapas temáticos realmente reflejen la realidad de la calidad del agua de este tramo del río Paraná y de la Plata.

La siguiente planilla muestra las áreas de control de cada una de las estaciones operadas por ANEEL

Estación	Curso de Agua	Area de Drenaje (km2)
Jupiá-Jtjsante	Paraná	478,000
Usina Promissao	Tieté	57,000
Usina Capivara Jusante	Paranapanema	85,120
Guaíra	Paraná	802,150
Foz do lguacú	Paraná	832,000
Parque Nacional lguacú	lguacú	67,459
Porto Murtinho	Paraguai	474,500
lraí	Uruguai	62,199

Por las grandes áreas que abarca, se verifica que un mayor número de estaciones son necesarias para conocer mejor el medio ambiente hídrico.

La red de monitoreo de calidad del agua de la Cuenca del Plata en territorio brasileño, viene siendo operada por varias instituciones federales y estatales, entre ellas ANEEL, desde 1979.

A partir de 1980 fueron seleccionadas 7 estaciones para que fueran oficialmente incorporadas a la red de monitoreo de calidad de la Cuenca del Plata. De este total, tres pasaron a pertenecer a la red mínima, cubriendo los ríos lguazú, Uruguay y Paraná.

El resto de las estaciones, situadas en puntos estratégicos, son operadas buscando un acompañamiento más efectivo de los parámetros de calidad del agua de la cuenca.

Actualmente están funcionando 8 estaciones. Los parámetros que se miden son de evaluación de características físicas y estéticas, de evaluación de contenido orgánico, de evaluación de nutrientes y de la productividad, de la evaluación de la agresividad natural, de la evaluación de la fuerza iónica, de la evaluación de características sanitarias, evaluación de presencia de metales, evaluación de compuestros industriales y agrícolas.

El esquema de información acordado había sido: informes de campo y de laboratorio, informes anuales de cada país, informe anual a nivel de cuenca,. informes plurianuales. El tratamiento estadístico inicial de los datos serían n° de muestras, valor medio, desvío padrón, valores máximos y mínimos.

Los datos recabados por todos los países son almacenados en Microcomputadoras, en planillas electrónicas o en bancos de datos comerciales tipo Access de Microsoft, o MSDPH, de ANEEL. Excepto de CETESB/SP y de FEPAM/RS, el acceso a los datos requiere largas negociaciones.

Los datos de la red del CIC no son divulgados sistemáticamente como tal. Hay informes anuales que los países deberían enviar al CIC, pero como en la mayoría no existen datos, ni los informes acordados se pueden enviar.

ANTEPROYECTO DE UN SISTEMA DE ALERTA HIDROLÓGICO

Dentro del proyecto “Sistema de Alerta Hidrológico” está operando desde 1986 una Red Hidrometeorológica que permitió el intercambio permanente de información entre los países miembros. A pesar de ello, en abril de 1993, se presentaban dificultades en la detección y manejo de crecidas en tiempo oportuno para la adopción de medidas de mitigación de los impactos sociales y económicos por ellas producidos.

Se previó la instalación de una Red Mínima Hidrometeorológica en tiempo real, destacándose que la operación de la red requería además de la realización de campañas de medición de caudales.

Red de alerta hidrológico

A pesar de dificultades de diversa índole, la interacción institucional se ha dado en situaciones de emergencia hídrica. Hay que tener en cuenta que además de ser necesario cubrir la información que es generada en cinco países, existen distintas jurisdicciones y entidades en cada país que se ocupan del relevamiento de datos hidrometeorológicos, por lo que la solución para armonizar todo ello es compleja.

Los criterios adoptados para la selección de lugares para las estaciones que integrarán la red fueron:

- Mínima cantidad para razonable operatividad del sistema, compatible con las necesidades de una interpretación adecuada del comportamiento de los ríos tributarios y de un seguimiento de la evolución de las tormentas
- Ubicación de los sitios de medición a lo largo de los cursos de los ríos de forma de estructurar un sistema troncal inicial

- Adecuadas condiciones de acceso a los sitios en la mayor parte del año
- Disponibilidad de las descargas de los grandes aprovechamientos hidráulicos en operación dentro de la región hídrica
- Aprovechamiento de sitios con largos períodos de registro por medios convencionales con equipo automático de recolección y transmisión de alguno de los datos de interés de esta red ya en operación
- Aprovechamiento de sitios con largos períodos de registro por medios convencionales
- Sitios con largos períodos de registro de niveles de ríos por medios convencionales preferentemente con información sistemática o esporádica de caudales pasantes

Un escollo encontrado consistió en la falta de interés demostrada por algunas entidades consultadas, operadoras de aprovechamientos hidroeléctricos en cuanto a poner a disposición del sistema la información sobre los caudales salientes de las obras hidráulicas a su cargo.

Tipo de datos a recolectar y frecuencias de interrogación

El equipo básico de una estación remota tipo de la Red de Alerta Hidrológico consta de una plataforma automática de recolección de datos conformada por una unidad electrónica programable, sensores de nivel de río y de precipitación, transmisor, batería, cargador y antena. La unidad inteligente es programada para que interrogue a los sensores a intervalos preestablecidos, datos que son almacenados en memoria local hasta que la transmisión de los mismos se establece con la estación maestra del centro receptor - procesador.

Todas las estaciones de la red, como se mencionó anteriormente, serán fluvio-pluviométricas, es decir tanto para registro de niveles de río como de la precipitación caída. Como en la mayoría de los sitios se efectúan aforos de caudales líquidos, la curva actualizada que relaciona caudales con niveles de río en el sitio también se integrará como un producto más del sistema.

Para evitar generar superabundancia de información el registro de niveles de río y precipitación será del tipo discretizado con intervalos de interrogación de una hora.

Para los usuarios el dato estará disponible en tiempo oportuno y no real. Los datos son enviados agrupadamente en paquetes y el tráfico de los mismos depende de cada sistema de telecomunicación que se emplee.

A tales efectos se cree conveniente establecer como condición de máxima que el sistema de telecomunicación que vincule grupos de estaciones remotas con una estación maestra debe ser tal que garantice una demora de hasta seis horas en la recepción del paquete de datos lapso que marcará el retraso máximo que para un usuario de la información tendrá el último dato.

Equipamiento a emplear de estaciones actualmente en operación

De este tipo de estaciones se han seleccionado 32 sitos de entre los que actualmente se encuentran en operación. Estas estaciones están atendidas por la Agencia Nacional de Energía Eléctrica de Brasil (ANEEL), la Dirección Nacional de Vías Navegables (DNVN) de Argentina y la Comisión Técnica Mixta de Salto Grande (CTMSG) (Argentina-Uruguay).

De la red que posee en operación la ANEEL se han seleccionado 20 estaciones dotadas con plataformas automáticas de recolección de datos con transmisión vía satélite que registran niveles de

río y precipitación con intervalo de interrogación de una hora, en la mayoría de las cuales se efectúan mediciones de caudales líquidos

Con referencia a la red que mantiene la empresa Hidrovía S.A. y cuyo responsable es la DNVN, se han seleccionado 8 estaciones con plataformas automáticas de recolección y transmisión de datos de niveles de río con transmisión tanto por vía satélite como por el sistema de telefonía móvil.

Por último restan 4 estaciones que registran niveles de río y precipitación que cuentan con equipamiento automático con interrogación mediante enlace en VHF atendidas actualmente por la CTMSG, de las cuales probablemente 3 de ellas queden a cargo de la Secretaría de Recursos Naturales y Desarrollo Sustentable de la Nación de Argentina, en razón de que integrarían la red actualmente en vías de implementación correspondientes al proyecto de modernización del sistema de generación de datos en tiempo real que llevan adelante siete provincias del litoral argentino para implementación con la operación del Centro Operativo de Alerta Hidrológico (COAH) .

Equipamiento a emplear de estaciones en vías de implementación

De este tipo de estaciones se han seleccionado 41 sitios entre los que actualmente se encuentran en diversos proyectos. Su concreción estaría concluida en los próximos dos años. Estas estaciones estarán dotadas con plataformas automáticas de recolección y transmisión de datos para registro de niveles de río y precipitación, con intervalo de interrogación de una hora, destacándose que en un alto porcentaje se efectúan o está previsto efectuar mediciones de caudales líquidos.

Los potenciales operadores de tales estaciones serían: la Secretaría de Recursos Naturales y Desarrollo Sustentable de la Nación, Argentina; la Dirección Nacional de Vías Navegables, Argentina; el Ministerio Obras Públicas, Paraguay; la Comisión Trinacional del Río Pilcomayo, Argentina-Bolivia-Paraguay; la Entidad Binacional Yacyretá, Argentina-Paraguay y la Comisión Binacional de Desarrollo de la Alta Cuenca del Río Bermejo y el Río Grande de Tarija, Argentina-Bolivia.

MEKONG RIVER

Introduction

The Mekong River basin in southeast Asia is shared by six countries. The basin area is almost 800,000km^2 and its population is around 100 million people. The river is an extremely valuable resource, in terms of its potential for hydro-electricity, irrigation, navigation, and fisheries, and the riparian countries include several which are in desperate need of economic development.

To promote development of this international resource, a formal basis for international cooperation, the Mekong Committee, was established in 1957. Its main function was "to promote, coordinate, supervise and control the planning and investigation of water resources development projects in the lower Mekong basin". It was supported by a Secretariat and an Advisory Board of international experts, with administrative costs met by the UNDP and costs of planning, investigations and studies by a variety of donor countries and the Asian Development Bank. The Indicative Plan for development of the lower Mekong was readied by 1970, on the basis of investigations costing several hundred millions of dollars, but was over-ambitious for the prevailing circumstances, and in many respects still is only at the feasibility stage. Only in the mid-1990s were the riparian countries approaching a state in which significant development of the Mekong's resources realistically could be undertaken, and the Agreement on Cooperation for Sustainable Development of the Mekong River basin was signed by Cambodia, Lao PDR, Thailand and Vietnam in 1995. This agreement established the Mekong River Commission.

Activities of the Mekong Committee

The activities of the Mekong Committee have been guided by an annual Work Programme reflecting the development priorities of the member countries, and increasingly the international aspects of development schemes. Core activities of the Secretariat have been the detailed and systematic collection of hydrological, meteorological, environmental, demographic, and economic data, effective analysis and interpretation, and management of information systems. The needs of each of the riparian countries are very diverse, and so too are the particular values that they associate with the river. However, a basic hydrological data collection programme, commencing in 1960, has attempted to meet all needs. A network of over 700 hydrological and meteorological stations was established which spanned a large part of the lower Mekong basin, and which included 13 stations from which observations have been relayed by radio to provide a flood and low flow forecasting capability. Hydrological stations provide river stage, velocity, streamflow, sediment load, bed material, water temperature, and water quality; meteorological stations provide precipitation, evaporation, wind, radiation, humidity, temperature, and seismic activity. Daily recordings have been compiled by the national services, and then conveyed to the Mekong Secretariat. The Mekong Committee Central databases have stored data from throughout the lower basin, to provide the ability to prepare Hydrological Yearbooks and an inventory of the basin's water resources, as a foundation for planning and project formulation.

Additional data collection programmes in the lower Mekong have included land use, crop suitability and geomorphological/soils maps prepared using field surveys, aerial photographs, and satellite imagery. Specific investigations and studies have considered the distribution of water-borne diseases, water quality, and salinity intrusion into the delta.

The data collection and investigation programmes have been used to promote technical cooperation among developing countries, as well as on-the-job training by personnel from other countries. Other educational opportunities provided through the Mekong Committee have included training courses, workshops, scholarships for technicians and others. A large number of people have received training and

education, not just in hydrology and engineering, but in other disciplines such as economics and statistics as well.

Despite the political impediments to its work, and incomplete participation by the riparian countries, the Mekong Committee has been widely regarded as a success story in international cooperation in river basin development planning. A key element of this has been the cooperative programme of data collection and archiving, which has provided the information resource required by all riparian countries for the preparation of proposals for sustainable development initiatives.