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**GRDC Status Report 1997**



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## Database development

In 1997, data were received for 237 stations. 85 stations were added as new stations in the database, while 151 of the already existing stations were updated. 17 countries have contributed data to the GRDC (see table 1 and annex 1 to this report).

| Country            | New | Updated | Total |
|--------------------|-----|---------|-------|
| Uruguay            | 6   | 2       | 8     |
| United Kingdom     | 0   | 9       | 9     |
| Russian Federation | 1   | 24      | 25    |
| Nepal              | 20  | 3       | 23    |
| Greece             | 7   | 3       | 10    |
| Israel             | 2   | 4       | 6     |
| Hungary            | 0   | 17      | 17    |
| Germany            | 1   | 10      | 11    |
| Netherlands        | 0   | 1       | 1     |
| USA                | 0   | 7       | 7     |
| Italy              | 1   | 1       | 2     |
| Ecuador            | 8   | 23      | 31    |
| Guyana             | 0   | 6       | 6     |
| Mekong Basin       | 0   | 32      | 32    |
| Trinidad & Tobago  | 5   | 0       | 5     |
| Australia          | 27  | 9       | 36    |
| Slovenia           | 8   | 0       | 8     |
| $\Sigma$           | 86  | 151     | 237   |

Table 1: Number of Stations, Update 1997

Over 50% of the newly included stations came from Australia and Nepal (a country mission to Nepal was performed in 1997). For the greatest part of the stations, time series could be obtained which reach into the early or mid 90's, so that the peak of the data shifted into more recent years. Annex 2, which displays the number of stations for every year, shows that the shift of data towards more recent years continued, but data providers must be requested to provide data in a more timely manner where this is possible in order to keep the database up to date. The peak of the time series lies around 1980, which is not so bad for historical time series - however, for many hydrological or climatological research purposes it would be useful to have more recent data, because of the overlapping with other datasets (e.g. remote sensing data), which are often only available for the last recent years. An institutionalized transfer of data from the providing countries to the GRDC is followed by a relatively small number of countries up to now.

The database now consists of 3658 stations, from which 2184 stations provide mean daily discharge data and 3232 stations provide mean monthly discharge data. An impression of the station locations worldwide and their spatial distribution gives annex 3 (world map). A complete station catalogue is available at the GRDC on request or can be downloaded directly from the Internet home page of the GRDC under the URL of <http://www.bafg.de/grdc.htm>. As an alternative download the ftp-server of the Federal Institute of Hydrology may be used: <ftp://anonymous@www.bafg.de/pub/grdc/cat>, where a zip-file with the 32-bit version of the database catalogue tool is ready to be downloaded.

## **Data acquisition activities**

On various occasions, GRDC reiterated its request for data provisions for the Centre. Country missions to Nepal and India as well as to Slovenia, the Mekong Secretariat, Russia and the Ukraine and other good contacts established in 1996 with countries of Latin America and the Caribbean resulted in a very satisfactory data acquisition in general, however, data deliveries from most African countries remain very low.

In general, one of the most important tasks for the near future will be to collect data for the major rivers of the world with a maximum of overlapping time series. Major difficulties in the collection of hydrological data are political constraints of many countries and the institutional capacity of the data-keeping organisations to provide data. In many cases, even the data of one country are often distributed over different institutions, depending on the administrative structure of the hydrological service of the country. In this respect, there is a growing importance of regional, multinational projects as FRIEND, WHYCOS or others for the global exchange of hydrological data and related information. Likewise, as the example of the Mekong Secretariat shows, close contacts to such basin- and regional institutions are gaining in importance.

## **Quality control**

As stated in the GRDC Policy Guidelines for the Dissemination of Data (annex 4), the providing agencies are responsible for the quality of the data. The import of raw data from the data providing agencies into the GRDC database includes an obligatory screening procedure of the data for obvious errors. Due to the time- and personnel-intensive testing procedures for in-depth quality control, the use of the GRDC Plausibility Software and other statistics-based software is applied only for specified projects and data sets within the GRDC.

In 1997, there were two datasets which were examined by a more detailed plausibility control. The first one was the dataset of 35 stations compiled for the Second Interim Report (Report No. 12) for the Arctic Climate System Study (ACSYS). This dataset was used for the calculation of river flows into the Arctic Ocean as a contribution to ACSYS. For a description of the correction method, please refer to GRDC report No. 15. Furthermore, a plausibility control was applied on the time series of the 160 stations near the mouth of major rivers used for the calculation of the freshwater fluxes into the world's oceans in GRDC report No. 10.

The time series of monthly and daily values were displayed as a graph on the screen and visually controlled. Any irregularities which could be located in this way were examined in the raw data and, if possible, corrected. A correction was only made when the correct value could be reconstructed without any doubt, for example if a wrong order of digits or a missing zero was detected. No data gaps were filled. In most cases the data correction could be applied using the method of linear interpolation or manual correction.

As a result, a very low error rate was found in the time series.

## Database technology

On the database server's side with the INFORMIX-database system running under UNIX, no major changes were made. On the other side, the operating system of the client's computers where the database query and evaluation software is performed, has been changed from DOS/Windows 3.x to Windows NT 4.0.

For 1998, initial steps are foreseen in the field of: migration of the database server to Windows NT, adaption of the clients software, realisation of an internet-access to defined subsets of the GRDC database (e.g. standard data set of 160 important stations, ACSYS data set) and the installation of an online-catalogue tool on the GRDC homepage which allows database catalogue queries directly on the GRDC-homepage via internet.

## Data requests and user services

In 1997, a total of 91 requests for the GRDC database has been processed, which is the same number as in 1996. Using the categorization from the 1996 report, the following user profile results (see table 2).

| Topic                               | Requests received 1997 | Requests 1996 |
|-------------------------------------|------------------------|---------------|
| Hydrometeorological modelling       | 11                     | 1             |
| Operational hydrology               | 16                     | 22            |
| Regional/global hydrological issues | 25                     | 20            |
| Climate and ocean related research  | 15                     | 31            |
| Information/advisory requests       | 19                     | 12            |
| Others                              | 5                      | 5             |
| Total                               | 91                     | 91            |

Table 2: Categorization of the database requests for 1997 and 1996

Compared with 1996, some differences can be seen: a strong decrease of requests in the fields of climate/ocean related research and a slight decrease in operational hydrology was registered. Substantially more requests were received for hydrometeorological modelling, regional/global hydrological issues and information/advisory terms. For the future a rising number of information/advisory requests is expected due to the increase of GRDC's involvement in water-related activities of United Nations agencies, governmental advisory services and project-related consulting activities.

In most cases, a reaction time of a few days could be kept from the receipt of the final request to the delivery of the data. A detailed description of the database requests including the requesting researcher and/or institution and purpose of data use is given in annex 5. As an important part of improved user services, the line of standard data products has been substantially increased and

includes now also flow-duration curves, variability plots of discharge and distribution functions as well as basic statistics.

The Database Catalogue Tool, which is a user-friendly software for the query of the database contents, is now available in a 16-bit (Windows 3.x) and 32-bit (Windows '95/NT) version. With both versions, a newly developed search tool is delivered together with the catalogue information. Figure 1 is a screen-dump of the database catalogue software, where the different selection criteria in the upper part of the window can be seen as well as an example catalogue query in the viewer below.

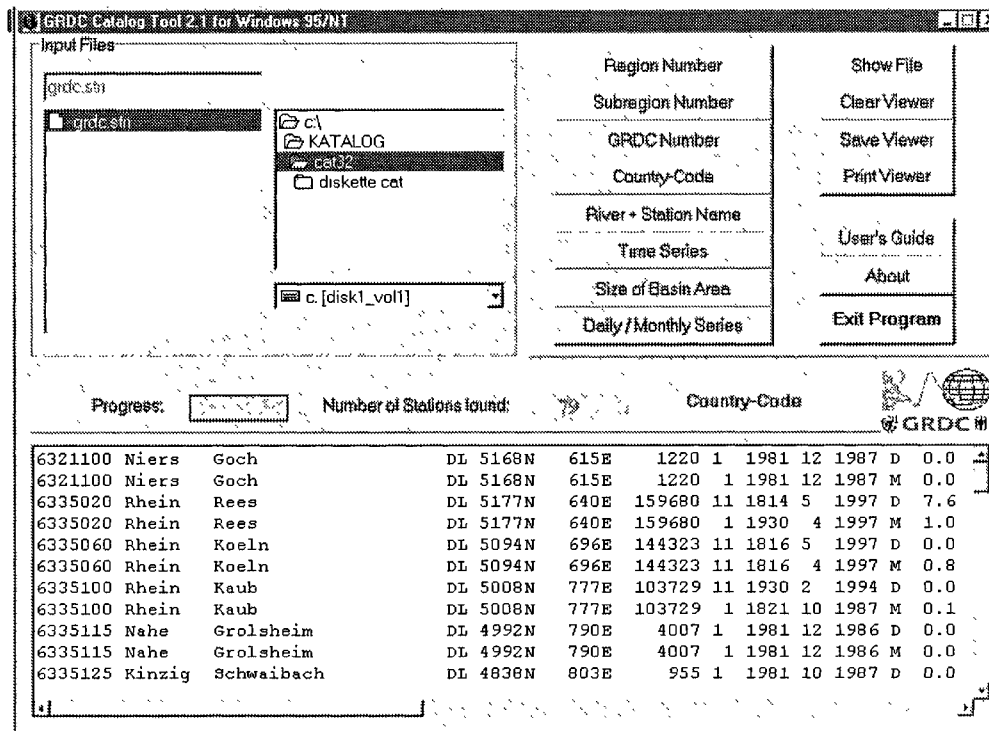


Figure 1: Screen-Dump of the Database Catalogue's main window

## Internet Homepage

With the installation of the web-server of the Federal Institute of Hydrology in 1997 the opportunity was given to set up a GRDC-homepage administered directly by GRDC/FIH. In August 1997, the GRDC homepage on the FIH-server became operational and has now (5/98) substituted the GRDC-pages on the Internet-server of the World Meteorological Organisation in Geneva. On the WMO server a link to the new homepage will remain, so that there will not be any changes for the user. As an advantage there will be a greater flexibility in operation and maintenance of the web page and a more timely access to updated catalogue information.

Since the page became operational in autumn 1997, 68 downloads of the GRDC database catalogue tool were registered until the end of the year 1997.

The new URL is: **<http://www.bafg.de/grdc.htm>**

A new ftp-server has been installed, where the GRDC database catalogue can be downloaded (32 bit version for Windows 95/NT) as a zipped file. The address is:

**<ftp://anonymous@www.bafg.de/pub/grdc/cat>**

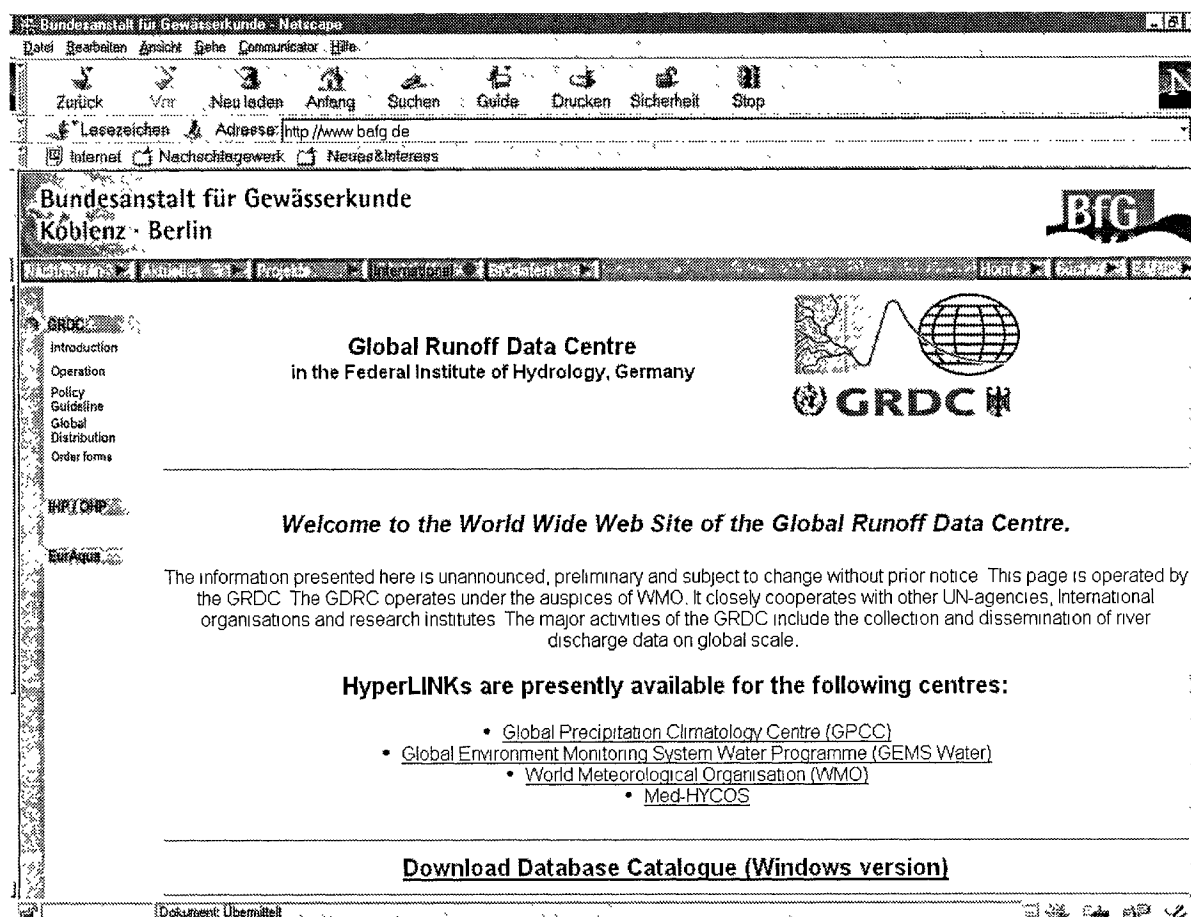


Figure 2: Screen-Dump of the frontpage of the GRDC-homepage ([www.bafg.de/grdc.htm](http://www.bafg.de/grdc.htm))

## GRDC Brochure

Based on the success of the English version of the brochure and on request by francophone and spanish-speaking countries, WMO has in 1997 provided to GRDC translations of the text. GRDC will publish the brochure in French and Spanish by the end of 1998.

## Research issues

As a contribution to the World Climate Programme Water (WCP-Water), the following three research projects are undertaken at the Federal Institute of Hydrology.

## **Transformation of measured runoff data to grid points**

The final report of this project has been submitted to the responsible Ministry and an executive summary is being prepared in English. Using the Weser and Elbe (Labe) catchments in Germany, monthly discharge values for the period 1971 to 1980 have been computed on a grid net. A Geographic Information System (GIS) is used as a tool for the computation of gridded discharge data. Data input to the GIS consists of internationally available sources as well as of a digital elevation map of the cited catchments. The grid size can be customized up to  $0.5 \cdot 0.5^\circ$  for projects in climatology and hydrology on regional and global scales. Though the results are encouraging, one of the methods being only based on measured discharge data requires a station density which is not available in many countries. Another method consists of a water balance model combined with measured discharge data of selected stations (see annex 6 for a more detailed abstract).

## **The development of a GIS-supported Water Balance Model as a Tool for the Validation of Climate Models and Hydrometeorological Datasets**

In the ongoing study, a grid-based water balance model is proposed following the THORNTHWAITE-MATHER procedure to calculate long term mean monthly water balance components on a  $0.5^\circ$  grid. Discharge data are used in several steps for parameter estimation as well as for validation and verification of the water balance components. The water balance model has so far been applied for a  $0.5^\circ$  grid covering Central Europe. Model validation was carried out for the rivers Rhine, Weser, Ems, Elbe (Labe) and the German part of the River Danube for the period of 1971-1980. This work is continued (see annex 7 for a more detailed abstract).

## **Statistical evaluation of river discharge data**

Using a series of well-established statistical methods for data analysis and time-series investigation, GRDC embarked on an exercise to publish statistical properties of rivers on a regional, continental and - where appropriate - global basis. Supplied on request together with the data, these analysis allow an assessment of river flow properties for users. In view of the interests of major data user groups such as hydrometeorological modelling as well as climate related research (i.e. validation of Global Circulation Models) a special focus is set on the analysis of trends, autocorrelation and jumps in the discharge time series.

The statistical package assembled for this purpose at the GRDC is based on the WCP-Water Project A.2 (Analyzing long time series of hydrological data and indices with respect to climate variability and change), a HOMS-component (Hydrological Operational Multipurpose System) of the Czech Hydrometeorological Institute (CHMI) and on a EU-fincanced project of the Ruhr-Universität Bochum (RUB) and may be modified as a result of feedbacks which are expected from the publication of the first cross-regional pilot report in August 1998. For more detailed information see annex 8.

## **Regional activities**

GRDC's regional activities in 1997 were focused on WMO-Region II and included country missions (see above) and advisory services to several hydrological services and regional institutions such as ESCAP in Bangkok. As mentioned in the section on data acquisition above, GRDC views the strengthening of its regional activities linked to existing and emerging regional bodies as increasingly important.

Africa, being under-represented in the GRDC's regional activities needs an effort by GRDC to assist in capacity building i.e. in the context of SADC-HYCOS.

## **Steering Committee 1997 - major results**

The third meeting of the Steering Committee convened from March, 25 to 27 in the Federal Institute of Hydrology in Koblenz, Germany. A commented member list of the Steering Committee is given in annex 9. A complete documentation of this meeting is given in the GRDC Report No. 17. As an outcome of this Steering Committee meeting there are the following main results:

- Harmonization of the GRDC Policy Guidelines with the following recommendations and resolutions of WMO and UNESCO:
  - Draft Resolution of the Tenth Session of the Commission of Hydrology (Koblenz, December 1996) for the exchange of hydrological data, which was formulated in parallel to Resolution 40 (Cg-XII) for the exchange of meteorological data and which has subsequently been endorsed by EC-XLIX (June 1997)
  - Resolution of the Intergovernmental Council for the International Hydrological Programme (IHP) of UNESCO, which invites member states to review their exchange of hydrological data
- GRDC contributes to the World Climate Programme Water with mainly two projects and has the role of a key service provider for WCP-Water projects and other WCP-Programmes. The two projects are Project A.5 „Collection of Global Data Sets“ and A.8 „Detecting Global and Regional Runoff Trends by Monitoring Discharges of Selected Rivers“
- Because WHYCOS has a great potential as a principal source of near real-time hydrological data for the GRDC, GRDC is requested to liaise with the WMO Secretariat and the regional HYCOS offices to establish an institutional data transfer to the GRDC. GRDC is already collaborating with Med-HYCOS and SADC-HYCOS
- The collaboration of the regional FRIEND-projects and the GRDC should be strengthened in terms of data exchange, noting also the Resolution of the Intergovernmental Council for the IHP of UNESCO. GRDC is actively involved in the FRIEND Hindu Kush Himalaya Project
- GRDC is of potential value for GTOS, but as a first step a clear definition of the data needs has to be made. Presently, 161 stations have been identified by GRDC which could serve as an initial step to global monitoring system in hydrology. GRDC is a member of the GTOS steering committee
- Facing the growing freshwater needs and the need for a global outlook on freshwater availability, it is high time to leave national boundaries in data exchange. Starting points

- could be regional and global projects and the collaboration with regional economic and politic bodies. There is also a need to develop strategies to synthesize regional and global hydrological activities and exchange of data and information
- Amendment of the GRDC database with discharge and sediment database compiled by Milliman et al. for the IGBP/LOICZ project and the Global River Input (GLORI) database compiled by Meybeck with discharge, sediment load and selected chemical parameters
  - The collaboration with the Continental Scale Experiments (CSE's) of GEWEX should be intensified. One possible contribution of GRDC could be the statistical analysis of optimized runoff data sets delivered by the CSE's
  - GRDC will enhance its web-page with elements of electronic publishing and electronic access to certain data sets
  - GRDC will intensify its research activities in collaboration with other institutions and visiting experts.

## **GRDC Policy Guidelines**

The GRDC is the only data centre operating under the auspices of WMO that has a defined policy for the dissemination of data. During the Tenth Session of the WMO Commission for Hydrology in Koblenz (December 1996), a Draft Resolution for the exchange of hydrological data was prepared and later has been endorsed by the WMO Executive Council in May 1997 for review of the WMO congress in 1999. The GRDC guidelines for the dissemination of data and costing of services were harmonized to this resolution. The main principles of the guidelines were left unchanged: free and unrestricted access to the data for scientific purposes, costs only for the reproduction of the data, data will not be given to third parties without GRDC's consent, data providers are recognized as owners of the data which implicitly carries the obligation to correct errors and to provide quality-controlled data and related information.

The revised guidelines are attached as annex 4.

## **Participation in major programmes and projects**

### **WCP-Water**

The World Climate Programme - Water (WCP-Water) consists of four major components which are the global atmosphere, the world oceans, the cryosphere and the land surface with its surface and groundwater runoff (see figure 3). The main contribution of the GRDC to this programme are two projects: Project A.5, „Collection of global runoff data sets“ and Project A.8, „Detecting global and regional runoff trends by monitoring discharges of selected rivers“. Furthermore, the GRDC is involved in Project A.2, „Analyzing long time series of hydrological data and indices with respect to climate variability and change“. In this respect, the use of statistical software packages, such as the software developed by WMO, was discussed during the meeting of the Steering Committee and has now been assembled for operational use by GRDC. Some amendments should be made with the currently implemented functions, others should be added. The 7th WCP-water planning meeting in 1997 already recommended to organize an experts' workshop about possible amendments to this software package. This meeting is proposed to be

held at the Institute of Hydrology in Wallingford, UK in 1998/99.

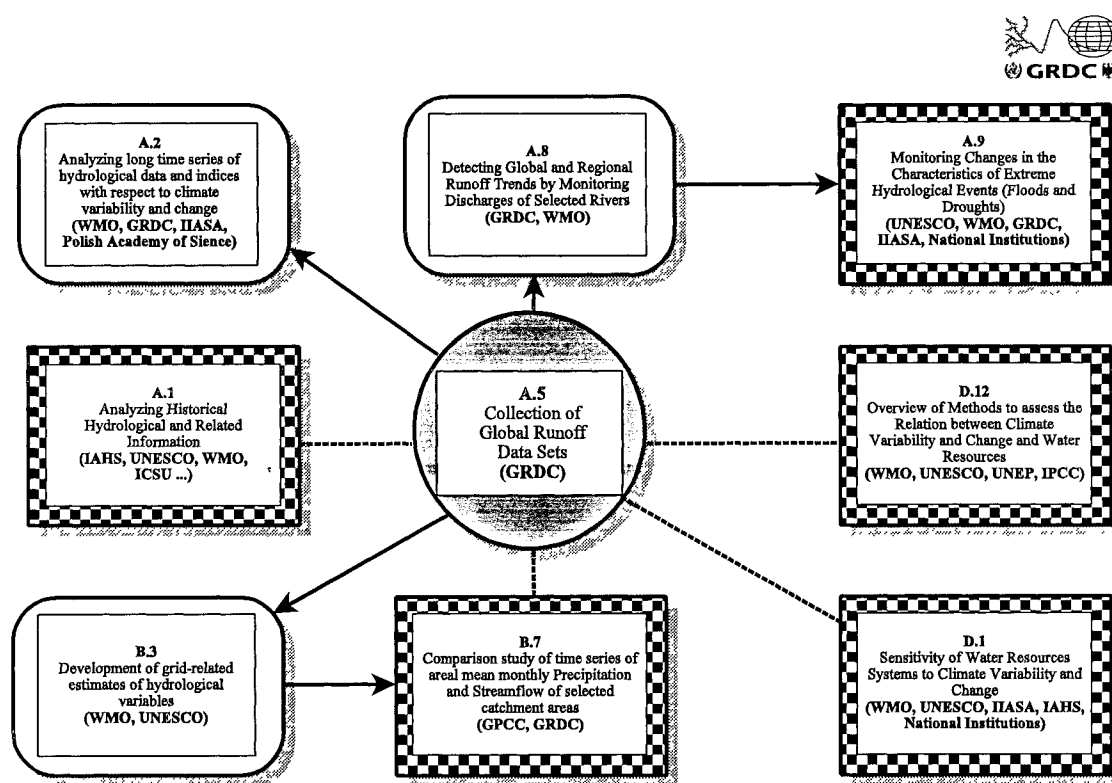


Figure 3: Liaison of the GRDC with other WPC Projects

## WHYCOS

The World Hydrological Cycle Observing System (WHYCOS) is funded by WMO, the World Bank, the European Union and other agencies and is organized in regional projects. The objective of WHYCOS is to provide a scientific basis for water resources monitoring, assessment and integrated water resources development and management at different scales. As a contribution to the knowledge of hydrological processes in their interaction with climate and the environment it will encourage sharing of hydrological data and information. It is expected that WHYCOS with its several regional projects may become one of the most important providers of near real-time hydrological data for the GRDC. Therefore it is important to take part as early as possible in the regional HYCOS projects. On the other hand, an important benefit for WHYCOS may consist of the ability of the GRDC to form a link between the regional activities, which is necessary for a hydrological network operating on a global scale.

Presently, GRDC is involved in one regional HYCOS project which is in an advanced stage of implementation: Med-HYCOS, the Mediterranean project of WHYCOS. In the Mediterranean region 23 riparian countries are involved in the Med-HYCOS Project (Mediterranean Hydrological Cycle Observing System) which is one regional part of WHYCOS. One of the objectives of Med-HYCOS is to build up a database with near-real time hydrometeorological

data including river discharge data. As data sources there are up to now 20 recently delivered data collection platforms with Meteosat-transmission capability as well as the already existing gauging stations.

In 1997, the collaboration between GRDC and Med-HYCOS was strengthened in the fields of database technology and data exchange. Med-HYCOS may become, together with the other regional HYCOS-projects, one of the most important providers of near-real time hydrological data. In 1997, GRDC took part in two meetings of Med-HYCOS - the meeting of the Initial Coordinating Group in Metkovic/Croatia and in the Meeting of the Regional Task Force 4 in Montpellier. Two scientists of ORSTOM, which is together with other agencies responsible for the implementation of Med-HYCOS, visited the GRDC. As a result, an agreement was set up about the collaboration and data exchange between GRDC and the Med-HYCOS regional data base. Furthermore, GRDC visited ORSTOM to intensify the collaboration in the field of database technology and data management.

GRDC expects to become actively involved in the SADC-HYCOS project which will be launched later in 1998.

## **UNESCO-FRIEND**

The UNESCO-FRIEND project from UNESCO (Flow Regimes from International and Experimental Network Data) is organised in several regional sub-projects. Although the focus for the data collection is on smaller catchments with a minimum of anthropogenic influence, there are some overlaps with GRDC data collection activities.

Data generated within the several FRIEND projects are restricted to members of the established FRIEND working groups and generally not accessible for others. Each regional FRIEND-project is responsible for its own data holding and for the possible access to the data. An example for this is FRIEND Northern Europe. GRDC has attained the role as data manager for Germany, Switzerland and Austria. The cooperation between GRDC and FRIEND is accentuated inter alia by the participation and involvement of GRDC and FRIEND in its respective Steering Committees and informal consultations.

From the viewpoint of GRDC, there is a need to establish a framework for data exchange between regional FRIEND projects and GRDC. In any case, FRIEND data which are published in yearbooks or published in electronic format should be made accessible to GRDC.

For the recently established FRIEND-project for the Hindu Kush Himalaya region (HKH-FRIEND), GRDC has responsibilities for the implementation of the regional database. The HKH-FRIEND is the first one where WMO/GRDC is directly involved together with UNESCO with the generous assistance of the German National IHP/OHP Committee.

## **GTOS / GCOS**

The main objective of GTOS, the Global Terrestrial Observing System, as given in the GTOS

mission statement, is to provide policy makers, resource managers and researchers with access to the data needed to detect, quantify, locate, understand and warn of changes (especially reductions) in the capacity of terrestrial ecosystems to support sustainable development. It is of importance for the GRDC that GTOS is promoting the exchange of data and applications.

Being represented in the GTOS Steering Committee, GRDC assists in the programme development of GTOS and promotes its aims and objectives. GRDC has offered GTOS to use its hydrological database, especially for global monitoring of the discharge situation. GRDC could assist GTOS in analyzing long term time series of discharge data. Up to now, 161 stations in the GRDC databases have been identified as appropriate for this task.

Regarding GCOS, the Global Climate Observing System, no specific actions were carried out by GRDC in 1997.

## **ACSYS**

The main objective of the ACSYS hydrology programme is to develop, test and refine macro-scale hydrological models which could be used to represent the essential continental link in the climatic feedback loop between the global atmospheric circulation, rainfall and evaporation, on the one hand, and the fresh water discharge from the Arctic Rivers to the Arctic Ocean, on the other hand.

In order to provide impetus for the collection of the required hydrological information for ACSYS, GRDC, on behalf of ACSYS, organises the international hydrological data exchange through a special Arctic Runoff Database (ARDB). Initially, only 15 stations were mentioned regarding the ARDB in the ACSYS Science Plan (1992), but up to now the database developed much more. The ARDB contains information of gauging stations of presently 233 rivers draining into the Arctic Ocean at gauge sites where hydrological observations were made or are made. ARDB is a separate project on behalf of ACSYS implemented within the GRDC using the same technical facilities.

In 1997, no official data from the countries participating in ACSYS were received by GRDC. For the future, there is a need to pursue an institutionalized transfer of hydrological data from the national hydrological agencies to the GRDC. Recognizing this situation, the ACSYS Steering Committee has planned an ad-hoc meeting in early 1998 to review the use of the ARDB.

GRDC is co-chairing the Data Management and Information Panel (DMIP) of ACSYS. The first meeting of this panel has been planned for early 1998 with the objective to produce a data and information directory as a first step for a comprehensive ACSYS Data Management and Information Plan.

## **GEWEX Hydrometeorological Panel (GHP)**

GRDC is an ex-officio member of the GHP. The collaboration between GHP and the GRDC

needs to be strengthened, especially regarding the CSE's (Continental Scale Experiments). It is expected that the CSE's needs for hydrological data will increase in the next years and more requests for hydrological data will be received by the GRDC. On the other hand, GRDC expects also contributions of CSE's to the GRDC database. During the third session of the GEWEX-GHP meeting in Sapporo in December 1997, the role of the CSE's in providing datasets which can be used i.e. for the validation of climate or hydrometeorological models and remote sensing applications was discussed.

One more possible contribution of the GRDC for the CSE's lies in the activities of the GRDC in the WCP-Water project A.8 (Detecting Global and Regional Runoff Trends by Monitoring Discharges of Selected Rivers).

## **INTAS**

GRDC cooperates with the Institute of Hydrology, Wallingford in a joint project to strengthen the data management of Russia, Belo-Russia and the Ukraine. The project is in its second year out of a project duration of three years. To promote data acquisition, management and dissemination in this project, GRDC participated in a high-level project meeting in Kiev, Ukraine.

## **GEMS/Water**

The Global Environment Monitoring System (GEMS/Water) of UNEP/WHO operates the global database for water quality data at the National Water Research Institute in Ontario/Canada. GEMS/Water intends to establish the GEMS/GLORI database (Global River Pollutant Discharges to Oceans) created by Meybeck, which contains discharge, sediment load and selected chemical parameters, at the GRDC as a step to link data and information for water quantity and quality. During the Session of the GRDC Steering Committee the committee recommended to transfer the discharge and sediment database compiled by Milliman et al. for the IGBP/LOICZ project (International Geosphere/Biosphere Project / Land-Ocean Interaction in the Coastal Zone) to the GRDC. More concerted activities are expected to follow under a renewed thrust for GEMS/Water and in particular for UNEP as a consequence of present developments within the UN System.

## **Visits to the GRDC**

In 1997, GRDC welcomed visitors from the following institutions:

- Lamont-Doherty Earth Observatory of Columbia University, USA
- National Water Research Institute, Canada
- Disaster Prevention Research Institute, Water Resources Research Center, Kyoto University, Japan
- Institute for Water Research, Rhodes University, Grahamstown, South Africa
- National Oceanic and Atmospheric Administration (NOAA), USA
- International Institute for Infrastructural, Hydraulic and Environmental Engineering Delft,

- The Netherlands
- Gesellschaft für technische Zusammenarbeit, Eschborn, Germany
  - Centro Interamericano de Desarrollo e Investigación Ambiental y Territorial, Mérida, Venezuela
  - ORSTOM (L'Institut français de recherche scientifique pour le développement en coopération), France.

## **New GRDC Reports**

In 1997, the following five reports have been published.

Report No. 13 (February 1997) is the GRDC Status Report 1996. For the future (starting 1998), GRDC intends to change the yearly rhythm for the Status report into a two-year rhythm, combined with the sessions of the Steering Committee. Interim news will be made available on the GRDC web site.

Report No. 14 (February 1997): The use of GRDC-information, Review of data use 1993/94 - Status January 1997. This report contains abstracts of research projects which have been undertaken by using data of the GRDC. 56 % of all users did answer to a questionnaire requesting information about their project. The lagtime of 2-3 years between the original request and this report was chosen because the typical duration of a research project is 2-3 years.

Report No. 15 (June 1997): Third Interim Report on the Arctic River Database (ARDB) for the Arctic Climate System Study (ACSYS): Plausibility Control and Data Corrections (Technical Report). This short report includes a description of methods and results of the plausibility control applied on the set of 35 ACSYS-stations which were used for the calculation of the river runoff into the Arctic Ocean.

Report No. 16 (August 1997): The GRDC database. Concept and Implementation. This report contains a detailed description of the database technology as well as of the dataflow, import/export routines, administrative tools and corresponding evaluation software used in the GRDC.

Report No. 17 (September 1997): Report on the Third Meeting of the GRDC Steering Committee, Koblenz, Germany, June 25-27, 1997.

For a recent list of GRDC-reports, see annex 10.

## **Annexes**

## Update List 1997

| Country   | Date       | GRDC-No. | River        | Station              | from-to   | Daily Monthly | New Update |
|-----------|------------|----------|--------------|----------------------|-----------|---------------|------------|
| Australia | 26.01.1998 | 5101020  | Pascoe River | Garraway Creek Junc. | 1970-1996 | D/M           | U          |
| Ecuador   | 22.05.1997 | 3819150  | Coca         | San Rafael           | 1982-1982 | M             | U          |
|           | 22.05.1997 | 3844400  | Daule        | La Capilla           | 1989-1994 | D             | U          |
|           | 22.05.1997 | 3844400  | Daule        | La Capilla           | 1982-1994 | M             | U          |
|           | 22.05.1997 | 3843100  | Mira         | D.J. Lita            | 1973-1988 | M             | U          |
|           | 22.05.1997 | 3844300  | Quevedo      | Quevedo              | 1982-1994 | D             | U          |
|           | 22.05.1997 | 3844300  | Quevedo      | Quevedo              | 1982-1994 | M             | U          |
|           | 22.05.1997 | 3844450  | Vinces       | Vinces               | 1989-1994 | D             | U          |
|           | 22.05.1997 | 3844450  | Vinces       | Vinces               | 1973-1994 | M             | U          |
|           | 22.05.1997 | 3822100  | Pastaza      | Banos                | 1989-1990 | D             | U          |
|           | 22.05.1997 | 3822100  | Pastaza      | Banos                | 1978-1990 | M             | U          |
|           | 22.05.1997 | 3844800  | Jubones      | D.J. San Francisco   | 1987-1994 | D             | U          |
|           | 22.05.1997 | 3844800  | Jubones      | D.J. San Francisco   | 1972-1994 | M             | U          |
|           | 22.05.1997 | 3846500  | Calera       | A.J. Amarillo        | 1972-1988 | M             | U          |
|           | 22.05.1997 | 3819100  | Quijos       | D.J. Oyacachi        | 1982-1992 | D             | U          |
|           | 22.05.1997 | 3819100  | Quijos       | D.J. Oyacachi        | 1979-1992 | M             | U          |
|           | 22.05.1997 | 3843500  | Ambi         | D.J. Cariyacu        | 1989-1994 | D             | U          |
|           | 22.05.1997 | 3843500  | Ambi         | D.J. Cariyacu        | 1973-1994 | M             | U          |
|           | 22.05.1997 | 3844100  | Esmeraldas   | D.J. Sade            | 1989-1991 | D             | U          |
|           | 22.05.1997 | 3844100  | Esmeraldas   | D.J. Sade            | 1972-1991 | M             | U          |
|           | 22.05.1997 | 3844200  | Toachi       | A.J. Pilaton         | 1989-1993 | D             | U          |
|           | 22.05.1997 | 3844200  | Toachi       | A.J. Pilaton         | 1973-1993 | M             | U          |
|           | 22.05.1997 | 3844150  | Granobles    | A.J. Guachala        | 1989-1994 | D             | U          |
|           | 22.05.1997 | 3844150  | Granobles    | A.J. Guachala        | 1971-1994 | M             | U          |
|           | 22.05.1997 | 3844460  | Zapotat      | Catarama             | 1982-1994 | D             | N          |
|           | 22.05.1997 | 3844460  | Zapotat      | Catarama             | 1982-1994 | M             | N          |

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|---------|------------|----------|------------|-------------------|-----------|---------------|------------|
|         | 22.05.1997 | 3844465  | Zapotal    | Lechugal          | 1982-1994 | D             | N          |
|         | 22.05.1997 | 3844465  | Zapotal    | Lechugal          | 1965-1994 | M             | N          |
|         | 22.05.1997 | 3822600  | Tomebamba  | Monay             | 1982-1994 | D             | N          |
|         | 22.05.1997 | 3822600  | Tomebamba  | Monay             | 1964-1994 | M             | N          |
|         | 22.05.1997 | 3822650  | Matadero   | Sayausi           | 1982-1994 | D             | N          |
|         | 22.05.1997 | 3822650  | Matadero   | Sayausi           | 1964-1994 | M             | N          |
|         |            |          |            |                   |           |               |            |
| Germany | 21.05.1997 | 6342900  | Danube     | Achleiten         | 1900-1991 | D/M           | U          |
|         | 21.05.1997 | 6342800  | Danube     | Hofkirchen        | 1900-1994 | D/M           | U          |
|         | 21.05.1997 | 6342500  | Danube     | Ingolstadt        | 1975-1987 | D/M           | U          |
|         | 21.05.1997 | 6342200  | Iller      | Kempten           | 1975-1987 | D/M           | U          |
|         | 21.05.1997 | 6343100  | Inn        | Wasserburg        | 1826-1980 | D             | U          |
|         | 21.05.1997 | 6343900  | Inn        | Passau-Ingling    | 1920-1989 | D/M           | U          |
|         | 21.05.1997 | 6343500  | Salzach    | Burghausen        | 1826-1989 | D/M           | U          |
|         | 02.07.1997 | 6357500  | Odra       | Eisenhüttenstadt  | 1988-1996 | D/M           | U          |
|         | 02.07.1997 | 6357010  | Odra       | Hohensaaten-Finow | 1990-1996 | D/M           | N          |
|         | 02.07.1997 | 6335020  | Rhein      | Rees              | 1996-1997 | D/M           | U          |
|         | 02.07.1997 | 6335060  | Rhein      | Köln              | 1992-1997 | D/M           | U          |
|         |            |          |            |                   |           |               |            |
| Greece  | 29.01.1997 | 6261300  | Aliakmon   | Ilarion           | 1962-1988 | M             | U          |
|         | 29.01.1997 | 6261100  | Arachthos  | Tsimovo           | 1964-1980 | M             | U          |
|         | 29.01.1997 | 6261200  | Achelooos  | Avlaki            | 1985-1991 | M             | U          |
|         | 29.01.1997 | 6264100  | Nestos     | Temenos           | 1965-1990 | M             | N          |
|         | 29.01.1997 | 6261310  | Almopaiois | Prof. Ilias       | 1988-1995 | M             | N          |
|         | 29.01.1997 | 6260100  | Aoos       | Konitsa           | 1963-1987 | M             | N          |
|         | 29.01.1997 | 6261400  | Kalamas    | Kioteki           | 1963-1978 | M             | N          |
|         | 29.01.1997 | 6261250  | Portaikos  | Pyle              | 1985-1994 | M             | N          |
|         | 29.01.1997 | 6261260  | Pamisos    | Moyzaki           | 1988-1995 | M             | N          |
|         | 29.01.1997 | 6262100  | Asopos     | Platani           | 1985-1993 | M             | N          |
|         |            |          |            |                   |           |               |            |
| Guyana  | 17.11.1997 | 3308300  | Mazaruniat | Apakwa            | 1987-1995 | D             | U          |
|         | 17.11.1997 | 3308100  | Barima     | Eclipse Falls     | 1981-1986 | D             | U          |

| Country | Date       | GRDC-No. | River       | Station          | from-to   | Daily Monthly | New Update |
|---------|------------|----------|-------------|------------------|-----------|---------------|------------|
|         | 17.11.1997 | 3308400  | Cuyuna      | Kamaria Falls    | 1987      | D             | U          |
|         | 17.11.1997 | 3308600  | Essequibo   | Plantain Island  | 1991-1995 | D             | U          |
|         | 17.11.1997 | 3309300  | Demerara    | Great Falls      | 1991-1995 | D             | U          |
|         | 17.11.1997 | 3309700  | Canje       | Reynold's Bridge | 1987-1995 | D             | U          |
|         |            |          |             |                  |           |               |            |
| Hungary | 04.02.1997 | 6442050  | Raba        | Szentgotthard    | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6442200  | Marcál      | Rabaszentmiklós  | 1990-1995 | D/M           | U          |
|         | 04.02.1997 | 6442300  | Kapos       | Kurd             | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6442450  | Danube      | Dunaalmas        | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6442500  | Danube      | Nagymaros        | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6442600  | Danube      | Mohács           | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444090  | Tisza       | Tiszabecs        | 1991-1995 | D/M           | U          |
|         | 04.02.1997 | 6444100  | Tisza       | Szeged           | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444110  | Maros       | Mako             | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444200  | Tisza       | Szolnok          | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444250  | Zagyva      | Jásztelek        | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444310  | Tisza       | Tiszapalkonya    | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444350  | Bodva       | Szendro          | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444380  | Sajo        | Felsozsolca      | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444400  | Fehér-Körös | Gyula            | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444500  | Kraszna     | Agerdomajor      | 1992-1995 | D/M           | U          |
|         | 04.02.1997 | 6444600  | Szamos      | Csenger          | 1992-1995 | D/M           | U          |
|         |            |          |             |                  |           |               |            |
| Israel  | 29.01.1997 | 6593700  | Soreq       | Near Gedera      | 1960-1992 | D             | U          |
|         | 29.01.1997 | 6593500  | Alexander   | Alyashiv         | 1967-1993 | D             | U          |
|         | 29.01.1997 | 6593800  | Be'er Sheva | Near Hatserim    | 1988-1993 | D             | U          |
|         | 29.01.1997 | 6594050  | Jordan      | Obstacle Bridge  | 1988-1993 | D             | U          |
|         | 29.01.1997 | 6594070  | Jordan      | Sede Nehemya     | 1984-1992 | D             | N          |
|         | 29.01.1997 | 6594080  | Jordan      | Naharyim         | 1988-1993 | D             | N          |
|         |            |          |             |                  |           |               |            |
| Italy   | 10.11.1997 | 6349200  | Adige       | Bronzolo         | 1975-1990 | D/M           | U          |
|         | 10.11.1997 | 6349300  | Adige       | Trento           | 1955-1981 | D/M           | N          |

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|--------------|------------|----------|---------------|----------------------|-----------|---------------|------------|
| Mekong Basin | 07.01.1998 | 2469055  | Se Kong       | Attopeu              | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469300  | Nam Lik       | Ban-Hin Heup         | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469049  | Nam Khan      | Ban Mixay (Ban Mout) | 1990-1993 | D             | U          |
|              | 07.01.1998 | 2469057  | Nam Ngum      | Ban-Na Luong         | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2469058  | Nam Ngum      | Ban-Pak Kahuoung     | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469111  | Nam Theun     | Ban-Signo            | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2469082  | Nam Chi       | Ban Chot             | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2969210  | Lam Dom Yai   | Ban Fang Phe         | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2969116  | Huai Khayung  | Ban Huai Khayung     | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469120  | Se Bang Hieng | Ban Keng Done        | 1990-1993 | D             | U          |
|              | 07.01.1998 | 2969115  | Nam Yang      | Ban Na Thom          | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2969081  | Huai Rai      | Ban Nong Kiang       | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2969069  | Nam Heung     | Ban Pak Huai         | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2969029  | Nam Mae Lao   | Ban Tha Sai          | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2369900  | Ea Krong      | Cau-14               | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2969010  | Mekong        | Chiang Saen          | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2969220  | Nam Mun       | Kaeng Saphu Tai      | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469110  | Se Champhone  | Kengkong             | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2369800  | Dak Bla       | Kontum               | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2469050  | Mekong        | Luang Prabang        | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469095  | Se Bang Fai   | Mahaxai              | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2969100  | Mekong        | Mukdahan             | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469060  | Nam Ou        | Muong Ngoy           | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469096  | Nam Kam       | Na-Kae               | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2969095  | Mekong        | Nakhon-Phanom        | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2969090  | Mekong        | Nong Khai            | 1992-1993 | D             | U          |
|              | 07.01.1998 | 2469260  | Mekong        | Pakse                | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2969124  | Nam Mun       | Rasi Salai           | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2969076  | Nam Pong      | Si Chomphu           | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2469265  | Se Done       | Souvanna Khili       | 1988-1993 | D             | U          |
|              | 07.01.1998 | 2969030  | Nam Mae Ing   | Thoeng               | 1988-1993 | D             | U          |

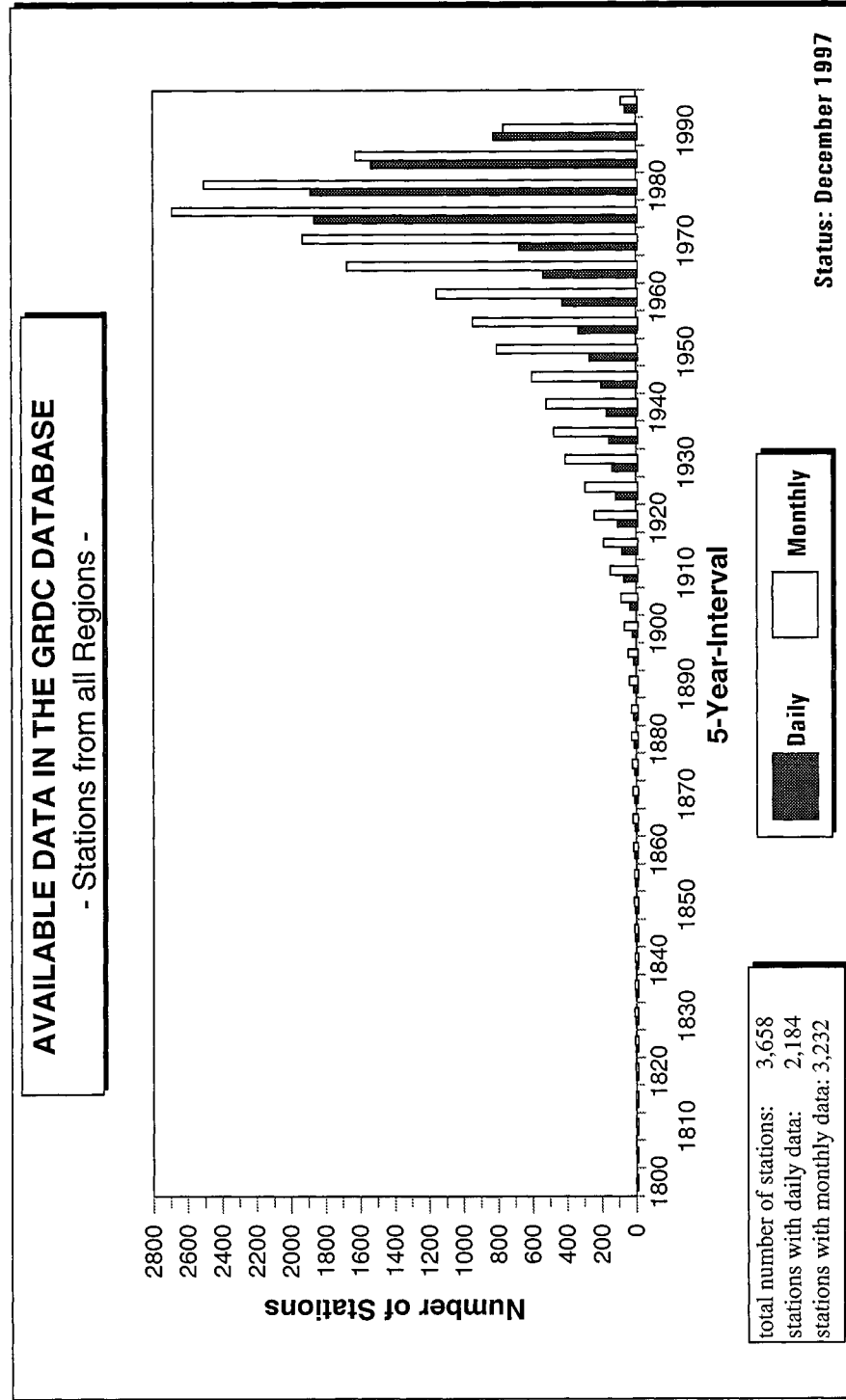
| Country     | Date       | GRDC-No. | River             | Station            | from-to   | Daily Monthly | New Update |
|-------------|------------|----------|-------------------|--------------------|-----------|---------------|------------|
|             | 07.01.1998 | 2969200  | Nam Mun           | Ubon               | 1992-1993 | D             | U          |
| Nepal       |            |          |                   |                    |           |               |            |
|             | 29.01.1997 | 2550110  | Tamakosi          | Busti              | 1971-1985 | M             | U          |
|             | 29.01.1997 | 2548400  | Karnali River     | Chisapani          | 1962-1993 | M             | U          |
|             | 29.01.1997 | 2548310  | Jhimruk Khola     | Tigra Gaon         | 1972-1977 | M             | U          |
|             | 29.01.1997 | 2548460  | Karnali River     | Asara Ghat         | 1962-1993 | M             | N          |
|             | 29.01.1997 | 2548450  | Karnali River     | Benighat           | 1963-1993 | M             | N          |
|             | 29.01.1997 | 2548500  | Bheri             | Jamu               | 1963-1993 | M             | N          |
|             | 29.01.1997 | 2548550  | Babai             | Bargadha           | 1967-1986 | M             | N          |
|             | 29.01.1997 | 2548350  | Mari Khola        | Nayagaon           | 1964-1985 | M             | N          |
|             | 29.01.1997 | 2548610  | Rapti             | Bagasoti Gaon      | 1976-1985 | M             | N          |
|             | 29.01.1997 | 2548620  | Rapti             | Jalkundi           | 1964-1985 | M             | N          |
|             | 29.01.1997 | 2549300  | Kali Gandaki      | Setibeni           | 1962-1993 | M             | N          |
|             | 29.01.1997 | 2549350  | Kali Gandaki      | Kotagaon Shringa   | 1964-1985 | M             | N          |
|             | 29.01.1997 | 2549400  | Seti              | Phoolbari          | 1964-1984 | M             | N          |
|             | 29.01.1997 | 2549235  | Burhi Gandaki     | Arughat            | 1964-1985 | M             | N          |
|             | 29.01.1997 | 2549500  | Narayani          | Devghat            | 1963-1993 | M             | N          |
| Netherlands | 02.07.1997 | 6435060  | Rhein             | Lobith             | 1990-1996 | D/M           | U          |
|             |            |          |                   |                    |           |               |            |
|             | 27.01.1998 | 5708125  | East Baines River | Victoria Highway   | 1963-1997 | D/M           | N          |
|             | 27.01.1998 | 5708126  | West Baines River | Victoria Highway   | 1961-1996 | D/M           | N          |
|             | 27.01.1998 | 5708110  | Victoria River    | Coolibah Homestead | 1967-1996 | D/M           | U          |
|             | 27.01.1998 | 5708145  | Daly              | Mount Nancarr      | 1969-1996 | D/M           | U          |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |
|             |            |          |                   |                    |           |               |            |

| Country            | Date       | GRDC-No. | River              | Station            | from-to   | Daily Monthly | New Update |
|--------------------|------------|----------|--------------------|--------------------|-----------|---------------|------------|
|                    | 27.01.1998 | 5708160  | Adelaide River     | Dirty Lagoon       | 1962-1996 | D/M           | N          |
|                    | 27.01.1998 | 5708185  | Mary River         | Mount Bundy        | 1956-1996 | D/M           | N          |
|                    | 27.01.1998 | 5709100  | Roper River        | Red Rock           | 1966-1996 | D/M           | N          |
|                    | 27.01.1998 | 5709110  | MacArthur River    | Mim Pump           | 1969-1996 | D/M           | N          |
| Queensland         | 26.01.1998 | 5101070  | Normanby River     | Battle Camp Cross. | 1967-1996 | D/M           | N          |
|                    | 26.01.1998 | 5101060  | Jeannie River      | Wakooka Road       | 1970-1988 | D/M           | U          |
|                    | 26.01.1998 | 5101080  | Daintree River     | Bairds             | 1968-1996 | D/M           | U          |
|                    | 26.01.1998 | 5101111  | Mulgrave River     | Gordonvale         | 1916-1988 | D/M           | N          |
|                    | 26.01.1998 | 5101116  | Russell River      | Bucklands          | 1938-1994 | D/M           | N          |
|                    | 26.01.1998 | 5101117  | N. Johnstone River | Goondi             | 1928-1968 | D/M           | N          |
|                    | 26.01.1998 | 5101118  | S. Johnstone River | Central Mill       | 1916-1996 | D/M           | U          |
|                    | 26.01.1998 | 5101130  | Tully River        | Buramo             | 1972-1994 | D/M           | U          |
|                    | 26.01.1998 | 5101161  | Herbert River      | Ingham             | 1915-1996 | D/M           | N          |
|                    | 26.01.1998 | 5101201  | Burdekin           | Home Hill          | 1921-1957 | D/M           | N          |
|                    | 26.01.1998 | 5101301  | Fitzroy            | The Gap            | 1964-1997 | D/M           | U          |
|                    | 26.01.1998 | 5101381  | Mary River         | Miva               | 1910-1996 | D/M           | N          |
|                    | 26.01.1998 | 5109110  | Gregory River      | Gregory Downs      | 1969-1996 | D/M           | N          |
|                    | 26.01.1998 | 5109170  | Gilbert River      | Rockfields         | 1967-1996 | D/M           | N          |
|                    | 26.01.1998 | 5109200  | Mitchell River     | Koolatah           | 1972-1996 | D/M           | N          |
| Russian Federation | 28.01.1997 | 6970100  | Onega              | Porog              | 1989-1993 | M             | U          |
|                    | 28.01.1997 | 6970150  | Vonguda            | Vonguda            | 1989-1993 | M             | U          |
|                    | 28.01.1997 | 6970120  | Kodina             | Kodina             | 1989-1993 | M             | N          |
|                    | 28.01.1997 | 6971750  | Nenkosa            | Nenkosa            | 1989-1992 | M             | U          |
|                    | 28.01.1997 | 6970250  | Northern Dvina     | Ust-Pinega         | 1989-1993 | M             | U          |
|                    | 28.01.1997 | 6970550  | Kuloy              | Kuloy              | 1989-1991 | M             | U          |
|                    | 28.01.1997 | 6970500  | Mezen              | Malonisogorskaya   | 1989-1993 | M             | U          |
|                    | 28.01.1997 | 6970560  | Peza               | Igunnovo           | 1989-1993 | M             | U          |
|                    | 28.01.1997 | 6970630  | Pesha              | Volokovaya         | 1989-1993 | M             | U          |
|                    | 28.01.1997 | 6970710  | Pechora            | Oksino             | 1989-1993 | M             | U          |
|                    | 28.01.1997 | 2912600  | Ob                 | Salekhard          | 1989-1994 | M             | U          |

| Country         | Date       | GRDC-No. | River             | Station                 | from-to   | Daily Monthly | New Update |
|-----------------|------------|----------|-------------------|-------------------------|-----------|---------------|------------|
|                 | 28.01.1997 | 2999500  | Pur               | Samburg                 | 1989-1990 | M             | U          |
|                 | 28.01.1997 | 2999250  | Taz               | Sidorovsk               | 1989-1994 | M             | U          |
|                 | 28.01.1997 | 2909150  | Yenisei           | Igarka                  | 1989-1995 | M             | U          |
|                 | 28.01.1997 | 2903420  | Lena              | Kusur                   | 1989-1994 | M             | U          |
|                 | 28.01.1997 | 2903430  | Lena              | Stolb                   | 1989-1994 | M             | U          |
|                 | 28.01.1997 | 2999850  | Khatanga          | Khatanga                | 1989-1991 | M             | U          |
|                 | 28.01.1997 | 2903150  | Anabar            | Saskylakh               | 1989-1994 | M             | U          |
|                 | 28.01.1997 | 2999920  | Olenek            | Sukhana                 | 1989-1994 | M             | U          |
|                 | 28.01.1997 | 2998110  | Yana              | Ubileynaya              | 1989-1994 | M             | U          |
|                 | 28.01.1997 | 2998400  | Indigirka         | Vorontsovo              | 1989-1994 | M             | U          |
|                 | 28.01.1997 | 2998450  | Alazeja           | Andrushkino             | 1989-1993 | M             | U          |
|                 | 28.01.1997 | 2998150  | Omoloy            | Namu                    | 1989-1993 | M             | U          |
|                 | 28.01.1997 | 2998510  | Kolyma            | Kolymskaya              | 1989-1994 | M             | U          |
|                 | 28.01.1997 | 2998800  | Paljavaam         | Paljavaam               | 1989-1995 | M             | U          |
|                 |            |          |                   |                         |           |               |            |
| Slovenia        | 13.11.1997 | 6545050  | Sava              | Catez                   | 1956-1994 | D/M           | N          |
|                 | 13.11.1997 | 6545190  | Sava              | Radovljica              | 1945-1994 | D/M           | N          |
|                 | 13.11.1997 | 6545200  | Krka              | Podbocje                | 1933-1994 | D/M           | N          |
|                 | 13.11.1997 | 6545300  | Savinja           | Veliko Sirje            | 1955-1994 | D/M           | N          |
|                 | 13.11.1997 | 6545400  | Ljubljanica       | Moste                   | 1946-1994 | D/M           | N          |
|                 | 13.11.1997 | 6546610  | Mura              | Gornja Radgona          | 1946-1994 | D/M           | N          |
|                 | 13.11.1997 | 6549180  | Soca              | Log Cezsoksi            | 1950-1994 | D/M           | N          |
|                 |            |          |                   |                         |           |               |            |
| South Australia | 27.01.1998 | 5402101  | Drain L           | Site A                  | 1971-1996 | D/M           | N          |
|                 | 27.01.1998 | 5402100  | Blackford Drain   | Amtd 4.0 km             | 1971-1996 | D/M           | N          |
|                 | 27.01.1998 | 5402102  | Drain M           | Amtd 5.1 km             | 1971-1996 | D/M           | N          |
|                 | 27.01.1998 | 5402110  | Reedy Creek       | 7.2 km NNE of South End | 1971-1996 | D/M           | N          |
|                 | 27.01.1998 | 5404270  | Murray            | Overland Corner         | 1985-1996 | D/M           | N          |
|                 | 27.01.1998 | 5405100  | Hindmarsh River   | Hindmarsh Valley        | 1969-1997 | D/M           | N          |
|                 | 27.01.1998 | 5405105  | Inman River       | Upstream STW            | 1995-1997 | D/M           | N          |
|                 | 27.01.1998 | 5405031  | Onkaparinga River | Clarendon Weir          | 1937-1997 | D/M           | N          |
|                 | 27.01.1998 | 5405041  | Torrens River     | Holbrooks Road          | 1978-1997 | D/M           | N          |

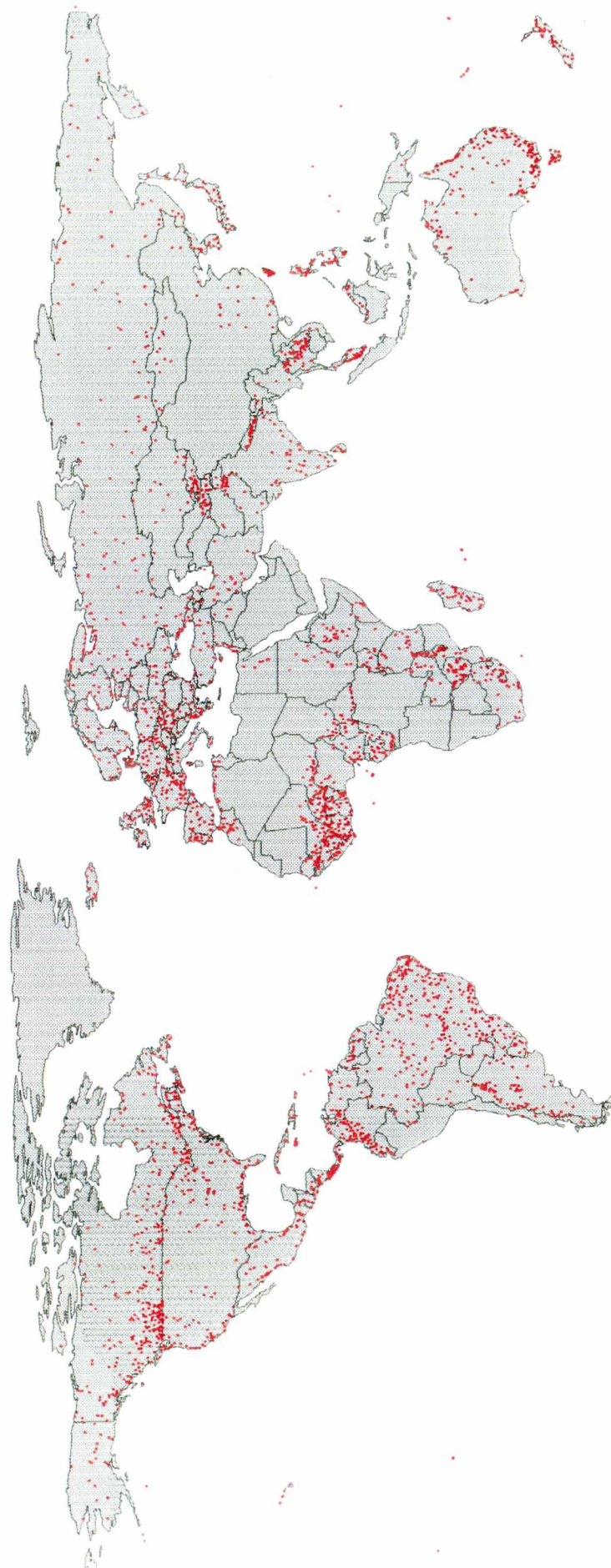
| Country           | Date       | GRDC-No. | River             | Station            | from-to   | Daily Monthly | New Update |
|-------------------|------------|----------|-------------------|--------------------|-----------|---------------|------------|
|                   | 27.01.1998 | 5405046  | Sturt River       | D/S Anzac Highway  | 1990-1997 | D/M           | N          |
|                   | 27.01.1998 | 5405048  | Brownhill Creek   | Adelaide Airport   | 1993-1997 | D/M           | N          |
|                   | 27.01.1998 | 5405130  | Rocky River       | Gorge Falls        | 1973-1997 | D/M           | U          |
| Trinidad & Tobago |            |          |                   |                    |           |               |            |
|                   | 08.01.1998 | 4186900  | Courland          | Courland           | 1974-1992 | D/M           | N          |
|                   | 08.01.1998 | 4186100  | Caroni            | Caroni Kelly       | 1967-1982 | D/M           | N          |
|                   | 08.01.1998 | 4186200  | Matura            | N. Oropuche        | 1975-1994 | D/M           | N          |
|                   | 08.01.1998 | 4186300  | South Oropuche    | S. Oropuche        | 1967-1982 | D/M           | N          |
|                   | 08.01.1998 | 4186400  | Ortoire           | Ortoire            | 1967-1994 | D/M           | N          |
| United Kingdom    |            |          |                   |                    |           |               |            |
|                   | 27.01.1997 | 6604650  | Spey              | Boat o Brig        | 1993-1994 | D             | U          |
|                   | 27.01.1997 | 6604750  | Tweed             | Norham             | 1993-1994 | D             | U          |
|                   | 27.01.1997 | 6605550  | Wharf             | Flint Mill Weir    | 1993-1994 | D             | U          |
|                   | 27.01.1997 | 6606400  | Bedford Ouse      | Bedford            | 1993-1994 | D             | U          |
|                   | 27.01.1997 | 6606900  | Waveney           | Needham Mill       | 1993-1994 | D             | U          |
|                   | 27.01.1997 | 6607200  | Exe               | Thorverton         | 1993-1994 | D             | U          |
|                   | 27.01.1997 | 6607150  | Taw               | Umberleigh         | 1993-1994 | D             | U          |
|                   | 27.01.1997 | 6604800  | Dec               | Woodend            | 1993-1994 | D             | U          |
|                   | 27.01.1997 | 6604610  | Tay               | Ballathie          | 1993-1994 | D             | U          |
|                   | 13.11.1997 | 6549100  | Soca              | Solkan             | 1945-1994 | D/M           | N          |
|                   |            |          |                   |                    |           |               |            |
|                   |            |          |                   |                    |           |               |            |
| Uruguay           | 06.01.1997 | 3469050  | Uruguay           | Salto              | 1992-1994 | D             | U          |
|                   | 06.01.1997 | 3458200  | Arroyo San Carlos | San Carlos         | 1983-1994 | D/M           | N          |
|                   | 06.01.1997 | 3471200  | Rio Yaguaron      | Paso Centuri       | 1980-1994 | D/M           | N          |
|                   | 06.01.1997 | 3458100  | Rio Santa Lucia   | Paso Pache         | 1983-1994 | D/M           | N          |
|                   | 06.01.1997 | 3471300  | Rio Cebollati     | Picada de Corbo    | 1980-1994 | D/M           | N          |
|                   | 06.01.1997 | 3471400  | Rio Olimar        | Treinta y Tres     | 1980-1994 | D/M           | N          |
|                   | 06.01.1997 | 3469210  | Tacuarembó        | Paso Borracho      | 1980-1994 | D/M           | N          |
|                   | 06.01.1997 | 3469300  | Caraguata         | Paso de las Toscas | 1980-1994 | D/M           | U          |
|                   |            |          |                   |                    |           |               |            |
|                   |            |          |                   |                    |           |               |            |
| USA               | 30.09.1997 | 4102100  | Kuskokwim         | Crooked Creek      | 1951-1993 | D             | U          |
|                   | 30.09.1997 | 4115200  | Columbia          | The Dallas         | 1878-1993 | D             | U          |

| Country | Date       | GRDC-No. | River        | Station    | from-to   | Daily Monthly | New Update |
|---------|------------|----------|--------------|------------|-----------|---------------|------------|
|         | 30.09.1997 | 4146280  | Sacramento   | Sacramento | 1948-1979 | D             | U          |
|         | 30.09.1997 | 4143550  | St. Lawrence | Cornwall   | 1935-1994 | D             | U          |
|         | 30.09.1997 | 4147700  | Susquehanna  | Harrisburg | 1993-1996 | D             | U          |
|         | 30.09.1997 | 4150500  | Brazos       | Richmond   | 1903-1993 | D             | U          |
|         | 30.09.1997 | 4149400  | Alabama      | Claiborne  | 1930-1975 | D             | U          |
|         |            |          |              |            |           |               |            |





# GRDC-Stations Status: December 1997



## **Preamble**

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. These Guidelines regulate the acquisition and dissemination of hydrological data and the costing of services by the Global Runoff Data Centre under the Terms of Reference stipulated during the First Session of the Steering Committee of the GRDC and the commitments of WMO made at its Twelfth Congress in 1995.

At its Twelfth Congress, the World Meteorological Organisation (WMO) adopted Resolution 40 (Cg-XII) and thus committed itself, as a fundamental principal, "to broadening and enhancing the free and unrestricted international exchange of meteorological and related data and products." In this context, "free and unrestricted" means non-discriminatory and without charge, the latter with the meaning "at no more than the cost of reproduction and delivery, without charge for the data and products themselves." With regard to the Global Runoff Data Centre, Congress also adopted Resolution 21 (Cg-XII) which encourages Members (countries) "to support the GRDC through the provision of the hydrological data and related information that it needs".

WMO Congress also adopted the practice that countries "should provide to the research and education communities, for their non-commercial activities, free and unrestricted access to all data and products exchanged under the auspices of WMO" with the understanding that the commercial use of these data may be subject to conditions." Resolution XII-4 (Paris, September 1996) of the UNESCO Intergovernmental Council for the International Hydrological Programme (IHP) "Invites Member States to review their policies for the international exchange of hydrological data so that they may be supportive of the research being undertaken on major global issues" and further "Requests the IHP National Committees to work with their national Hydrological Services to provide the scientific community with access to hydrological data and information needed for research at regional and international levels... using the internationally recognized international data centres".

These Guidelines do not infringe on the ownership rights of the data transmitted to the GRDC by Members (countries and their national agencies) and other data providers. In particular, the GRDC does not usually provide to data users value-added and costed services which would normally fall in the domain of Members and other data providers, in particular national Hydrological Services.

## **1. Principles of data acquisition and access**

- 1.1 The GRDC operates on the WMO principal mentioned above with the aim of encouraging the widespread use of the data for national, regional and global studies.
- 1.2 Members and other data providers are encouraged to transfer to the GRDC unrestricted, quality controlled, selected hydrological data, together with station history information. The transfer of daily discharge data is preferred.

## **2. Dissemination of GRDC-Data**

- 2.1 GRDC data are available to users free and unrestricted under the conditions specified in 2.2 to 2.6

below.

- 2.2 Requests for data must reach the GRDC in written form: letter, facsimile, telex or email. A proforma is attached for use in this respect (Annex 1).
- 2.3 The data user agrees in writing that the data received are not transferred to third parties without the written consent of the GRDC. GRDC data are released upon receipt of a signed User Declaration (Annex 2).
- 2.4 GRDC data shall not be used for commercial purposes without the prior consent of Members and other providers of data to the GRDC. The GRDC will request such consent on behalf of a potential user.
- 2.5 The data user agrees that the GRDC may inform the Members and other data providers of data about the use to which their data have been put and will transfer the names and addresses of the data users to Members and other data providers concerned.
- 2.6 The GRDC makes available subsets of the GRDC database on request, as stated above. Requests for the entire database or substantial parts of it cannot be entertained.

### **3. Cost of services**

- 3.1 Information about the GRDC, including the yearly status reports and the database catalogue, are provided free of charge upon request.
- 3.2 To enhance the services of the GRDC, 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.
- 3.3 Standard GRDC services (Annex 3) 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.
- 3.4 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 (Annex 4).
- 3.5 Under special arrangements, the cost for database queries may be waived for data users of developing countries.

### **4. Disclaimer**

While the GRDC makes every effort to eliminate errors from the data base, there may be errors in the data unknown to the GRDC. Neither the GRDC nor its sponsors can be held responsible for the consequences of the use of GRDC data.

## **Format for Data Request from GRDC**

Any request for data should provide the following information:

- a) Origin of the request, including name, postal and/or e-mail address, phone and fax number of the individual person or institute making the request; where an institute, the name and the position of the responsible officer should also be provided.
- b) Specification of request (e.g. which rivers, stations or regions, monthly or mean daily data, time series).
- c) Rationale for the data request.
- d) Detailed description of the use to be made of the data. A summary of the research or study project should be added to the request.
- e) Signature of the person or responsible officer referred to in a) above.

## Declaration of the Data User

The undersigned declares that he/she is cognizant of the GRDC Policy Guidelines for the Dissemination of Data and Costing of Services and is responsible for the use of the data provided by the GRDC. The undersigned agrees to use the data under the following conditions:

1. The GRDC data are not transferred either in part or total to third parties or to the general public (e.g. by electronic media), without the written consent of the GRDC.
2. The data will not be used for commercial purposes without the written consent of the GRDC. The GRDC itself will obtain clearance from the respective Members or other data providers prior to the release of data for commercial purposes.
3. The data set will be not accessible to unauthorized persons and, after completion of the specified studies, the data set will be kept separate from the general data processing facilities on diskette, tape or CD.
4. After completion of the studies and parts thereof, two copies of the results will be made available for the GRDC, as well as publications arising from the use of the data set or parts thereof.
5. In all publications, the source of the data will be fully cited as: "The Global Runoff Data Centre, D - 56068 Koblenz, Germany".
6. The GRDC operates on a non-profit basis. In certain cases, however, the GRDC may charge the data user a nominal amount for data queries and handling or an amount which has been agreed upon between the requesting agency and the GRDC prior to data delivery. The undersigned confirms his/her capacity to pay bills presented by the GRDC for services.
7. Disclaimer

While the GRDC makes every effort to eliminate errors from the data base, there may be errors in the data unknown to the GRDC. Neither the GRDC nor its sponsors can be held responsible for the consequences of the use of GRDC data.

I, as principal researcher/representative of the requesting organization, agree to the conditions stated above.

Place and date : \_\_\_\_\_

Signature : \_\_\_\_\_

## **Standard Services of GRDC**

The following standard services are rendered on a routine basis and are distinguished from specialized services to data users:

- Production and dissemination of catalogues and yearly status reports
- Database queries and response to data requests including advisory services with regard to the use of the database
- Compilation of project/programme related sub - databases
- Production of tables and graphs to illustrate and enhance the understanding of the content of the database
- Production of reports in the GRDC - Report series for example on global/regional hydrological issues, in the interest of projects/programmes of, inter alia, WMO, UNEP and UNESCO

The GRDC holds the right to change the extend and scope of standard services without notice.

Examples of specialized services would be: detailed statistical analyses of regional time-series for specific studies; assessment reports; production of graphical displays; monitoring of global/regional runoff on a comparative basis; production of reports on special request; etc.

## Cost of GRDC Services

1. Staff time is based on a per hour rate which in June 1997 was set at DM 75,--. This includes all overheads and mail services.
2. To give an indication of the approximate costs of databank services, the following can serve as a guide:

- a) Simple queries, such as a search for all stations of three major rivers and the extraction of mean daily discharge data:

Estimated time for completion: 1.5 hours  
Approximate cost (June 1997) : DM 112,50

- b) Complex queries, such as the selection of daily discharge time series of at least 20 years for 20 stations from three major rivers, with maximum overlap of time series:

Estimated time for completion: 5 hours  
Approximate cost (June 1997) : DM 375,--

3. For complex tasks where data products (statistical evaluations, graphics, etc.) are also requested, a cost estimate is made and agreed upon in advance.
4. Services for projects which require extensive work at the GRDC or the establishment of an own 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.
5. Payment for services is by bank transfer to the credit of the GRDC:

**BUNDESKASSE KOBLENZ, LANDESZENTRALBANK KOBLENZ**  
**BLZ: 570 000 00, ACCOUNT: 570 010 01, credit: 1203/11902 GRDC**

Cheques sent by registered mail and made payable to "GRDC" are also acceptable.

## Database Requests 1997

Annex 5

| Request made by<br>(Name, country)                                                                                   | Country or river for which<br>data were requested                                      | Purpose of data use                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Tommaso Abrate,<br>Hydrology Division, World<br>Meteorological Organisation                                          | Database catalogue of<br>Albania                                                       | General information about<br>the availability of discharge<br>data of Albania                                              |
| Alfredo Constain Aragon,<br>Hydroproiet Ltd., Cali,<br>Columbia                                                      | Statistical data of Latin<br>American rivers (flow,<br>velocity)                       | Calibration of digital<br>instruments (no data<br>transferred)                                                             |
| Simon Bärtschi,<br>Geographisches Institut der<br>Universität Bern, Schweiz                                          | 22 stations in the Aral-Sea<br>basin                                                   | Study about the media<br>coverage of hydrological<br>and environmental changes<br>in the Aral-Sea region                   |
| Connely Baldwin, Civil and<br>Environmental Engineering,<br>Utah State University, USA                               | River discharge data from<br>Columbia, Venezuela, Peru,<br>Brazil (database catalogue) | Dynamic analysis of<br>streamflow data (student) -<br>request pending                                                      |
| Prof. Dr. D.K. Banerjee,<br>School of Environmental<br>Sciences, Jawaharlal Nehru<br>University, New Dehli,<br>India | Yamuna River, India (not<br>present in the GRDC<br>database)                           | Study on the chemical<br>modelling of streams                                                                              |
| Dr. Peter Becker, Battelle<br>Marine Sciences Lab.,<br>Sequim, USA                                                   | ACSYS-reports, general<br>information about ACSYS                                      | PhD dissertation: The Effect<br>of Arctic River Hydrological<br>Cycles on the Arctic Ocean                                 |
| Dr. J.M. Beckers, Université<br>de Liege, Belgium                                                                    | 6 stations in the area of the<br>Mediterranean Sea                                     | MEDMEX (Mediterranean<br>Models Evaluation<br>Experiment)                                                                  |
| Prof. Dr. Beese, Institut für<br>Bodenkunde und<br>Waldernährung, Universität<br>Göttingen, Deutschland              | GRDC Catalogue                                                                         | Study on hydrology and<br>water quality worldwide for<br>the Scientific Council of the<br>Federal Government of<br>Germany |
| Byron Bodo, c/o<br>GEMS/WATER<br>Collaborating Centre,<br>Ontario, Canada                                            | GRDC catalogue                                                                         | General information about<br>GRDC database contents                                                                        |
| J. Böhner, Geographisches<br>Institut der Universität<br>Göttingen                                                   | Yangcun at Yaluzangbu<br>Jiang River                                                   | Verification of models for<br>the regionalization of<br>climatological parameters                                          |

| <b>Request made by<br/>(Name, country)</b>                                          | <b>Country or river for which<br/>data were requested</b>                               | <b>Purpose of data use</b>                                                                                                         |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| A. Brismar, Department of Water and Environment Studies, Linköping, Sweden          | GRDC-Report No. 5, database catalogue, report list                                      | General information about the availability of data in the Euphrates-Tigris Region                                                  |
| Dr. Axel Bronstert, Potsdam-Institut für Klimafolgenforschung e.V., Germany         | 16 stations in the North-East of Brazil                                                 | Development of a hydrologic model in certain areas in the North-East of Brazil                                                     |
| Ted Bryant, University of Wollongong, Australia                                     | GRDC-Reports 5 and 10                                                                   | Interaction between river discharge and sea level as indicators of the world water balance                                         |
| Zhou Caiping, The Chinese Academy of Sciences                                       | Data for the Brahmaputra River (database catalogue extract)                             | N.N.                                                                                                                               |
| Anny Cazenave, Laboratoire d'Océanographie et de Géophysique, Toulouse, France      | Data of rivers discharging into large lakes (database catalogue)                        | Study: global climatologies and the annual lake cycles                                                                             |
| Chen-Hua Chung, Dept. of Civil Engineering, Colorado State University               | Discharge data of the Niger River                                                       | Study: Return period and risk analysis for hydrologic and environmental processes                                                  |
| Arthur Lyon Dahl, DAED, Coordinator, UN System-wide Earthwatch, Geneva, Switzerland | GRDC report list                                                                        | Preparation of a bibliography of major reviews and metadata sources relating to international waters                               |
| Georgi Daskalov, ORSTOM-HEA, CESMA, Montpellier, France                             | 27 rivers draining into the Black Sea                                                   | Research project: Evolution of the Black Sea production ecosystem in relation to environmental changes and anthropogenic influence |
| Michael Dettinger<br>U.S. Geological Survey                                         | River discharge data for 14 rivers from China, Canada, Iceland, Denmark, United Kingdom | Assessment of climatic change and hydrological consequences in the Sierra Nevada and other parts of the Western United States      |

| <b>Request made by<br/>(Name, country)</b>                                                                 | <b>Country or river for which<br/>data were requested</b>                                    | <b>Purpose of data use</b>                                                                                        |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Dr. Isabelle Niang-Diop,<br>Département de Géologie,<br>Université Cheik Anta Diop,<br>Dakar-Fann, Senegal | -----                                                                                        | Request for general support<br>in the preparation of a<br>database for the coastal zone<br>of Senegal             |
| Jay Famiglietti, Dept. of<br>Geological Sciences,<br>University of Texas, Austin,<br>USA                   | GRDC report No. 10                                                                           | Possible incorporation of<br>GRDC data in an oceanic<br>global climate model                                      |
| Jane Foster, Dept. of<br>Geology and Geophysics,<br>Yale University, New<br>Haven, USA                     | 9 rivers of Southwest Asia                                                                   | Investigation exploring<br>climate variation and the<br>effect on agricultural<br>production in Southwest<br>Asia |
| Christian France-Lanord,<br>Dept. of Geological<br>Sciences, Cornell<br>University, Ithaca, USA            | GRDC Reports No. 5 and<br>10                                                                 | General scientific interest                                                                                       |
| Paul Ganahl,<br>Hydrographische Abteilung<br>der Verbund-Elektrizitäts-<br>werke Kaprun                    | Discharge data of the<br>Spanish Rivers Tortosa and<br>Zaragoza                              | Examination of possible<br>climatic changes in the Ebro<br>basin                                                  |
| Philippe Gauzelin, Space<br>Oceanography Departement,<br>CLS, Toulouse, France                             | Mediterranean Region<br>(general information about<br>data availability, request<br>pending) | PhD thesis about the water<br>and heat flux budget of the<br>Mediterranean Sea                                    |
| Pieter van Gelder, Delft<br>University of Technology,<br>The Netherlands                                   | Discharge data of stations in<br>the Oder catchment<br>(database catalogue)                  | Frequency analysis of<br>extreme values (maxima)                                                                  |
| Christian Gerbich, Inst. für<br>Biogeochemie und<br>Meereschemie, Hamburg,<br>Germany                      | Several rivers in the tropical<br>and subtropical region of<br>Asia                          | Modelling transport<br>mechanisms of solid and<br>dissolved matters in oceans<br>and rivers                       |
| Marc Gordon, Centre for<br>Arid Zone Studies, UK<br>University of Cambridge                                | Historical streamflow data<br>for the Benue River Basin<br>(catalogue)                       | MSc Dissertation in Water<br>Resources                                                                            |

| <b>Request made by<br/>(Name, country)</b>                                                            | <b>Country or river for which<br/>data were requested</b>         | <b>Purpose of data use</b>                                                                           |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Steve Graham, Dept. of Geological Sciences, University of Texas, Austin, USA                          | Report No. 10, 5, 12, 14                                          | General scientific purposes                                                                          |
| Dr. Alan Hall, Australia                                                                              | GRDC catalogue for Australia                                      | General reference purposes                                                                           |
| G. Hartmann, Institut für Wasserbau, Universität Stuttgart                                            | GRDC database catalogue                                           | General information about the availability of discharge data in Africa and the Middle East           |
| Martin Hollingham, University of Wales, Bangor, UK                                                    | GRDC report No. 5 and No. 10, Status Report 1996                  | General research work and educational purposes                                                       |
| Kaisa Hietala, Scott Polar Research Institute, University of Cambridge, U.S.A                         | 35 ACSYS-stations                                                 | PhD thesis: Fresh water variation on the Arctic Ocean                                                |
| Noboyuki Imanishi, Shinko Research Ltd., Tokyo, Japan (research company of Kobel Steel Ltd.)          | GRDC database catalogue                                           | Global Potential of hydrogen gas production by hydropower (no transfer of raw data - commercial use) |
| S.R. Jones, Engineering Consultant, The Harroway, Whitchurch, UK                                      | Data of the Casamance River, Senegal (data not available at GRDC) | Undersea fiber optics cable project South America - Africa                                           |
| Shinya Kakuta, Ocean Research Department, Japan marine science and technology center, Yokosuka, Japan | Data of the Yukon River                                           | Model study within ACSYS (Arctic Climate System Study)                                               |
| Frank Kaspar, Wissenschaftl. Zentrum für Ökosystemforschung, Universität Kassel, Germany              | 43 stations from South America                                    | Global modelling of consumption, availability of water and prognosis                                 |
| Prof. Kempe, Geologisch-Paläontologisches Institut, Technische Universität Darmstadt, Germany         | Database catalogue of Argentina (request pending)                 | EU-research project: biogeochemistry of of Argentinian Rivers                                        |

| <b>Request made by<br/>(Name, country)</b>                                                   | <b>Country or river for which<br/>data were requested</b>                    | <b>Purpose of data use</b>                                                                                     |
|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Chris Kilsby, Water Resources Systems Res. Lab., Univ. of Newcastle upon Tyne, UK            | GRDC database catalogue (request pending)                                    | General information                                                                                            |
| Tokuo Kishi, Surface Hydrology Modeling Team, NIED, Science & Technology Agency, Japan       | General information about availability of data of the GRDC (request pending) | Study on the hydrologic characteristics of major rivers of the world                                           |
| Wulf Klohn, Food and Agricultural Organisation of the United Nations, Rome, Italy            | 31 rivers of the Amu Darya and Syr Darya region                              | Study of water resources of river basins in the countries of the former SU within the FAO's Aquastat Programme |
| Jumpei Kubota, Faculty of Agriculture, Tokyo University of Agriculture and Technology, Japan | Discharge data for 14 Arctic rivers                                          | GAME-Siberia (GEWEX related Asian Monsoon Experiment) Project                                                  |
| Dr. D. Krämer, World Meteorological Organisation, Genf, Switzerland                          | Discharge data for 8 stations in mountainous regions                         | Edition of the book "State of the World Mountains 1997"                                                        |
| Dr. Gerhard Lammel, Max-Planck-Institut für Meteorologie, Hamburg                            | Zaire, Senegal, Nile                                                         | Contribution to a report of the Scientific Council for Environmental Changes of the Federal Government         |
| Richard Lammers, University of New Hampshire, Durham, USA                                    | Arctic Region                                                                | Reports 8, 12, 15 (ACSYS-Reports)                                                                              |
| Howard Lawes, Noble Denton Europe Ltd., London                                               | General data (means) for the Irrawaddy River Report No. 5                    | Design of a submarin pipeline through the Irrawaddy delta                                                      |
| Prof. Lemke, Institut für Meereskunde, Universität Kiel                                      | Several major rivers of the world                                            | Educational; general statistical evaluation                                                                    |
| Winchee Lin, School of Oceanography, University of Washington, USA                           | Discharge data for 34 rivers in the South East Asia Region                   | Validation of a model for the biogeochemistry of rivers                                                        |

| <b>Request made by<br/>(Name, country)</b>                                                                                                                              | <b>Country or river for which<br/>data were requested</b>                                         | <b>Purpose of data use</b>                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dr. Dag Lohmann,<br>Department of Civil<br>Engineering and Operations<br>Research, Princeton<br>University, USA                                                         | 161 stations globally<br>distributed                                                              | Modeling of global soil<br>moisture, evaporation and<br>runoff with the VIC-2L<br>model                                                                              |
| Sarith Mahanama<br>Dept. of Civil & Structural<br>Engineering<br>The University of Hong<br>Kong                                                                         | 16 stations in the Mekong<br>River Basin                                                          | Validation of GCM with<br>respect to daily river runoff                                                                                                              |
| Lee McKinney, Sverdrup<br>Technology, Stennis Space<br>Center, USA                                                                                                      | 10 stations of rivers<br>discharging into the East<br>Asia Sea                                    | Ocean modelling project in<br>the East Asia Sea                                                                                                                      |
| John Maingi, Office of Arid<br>Lands, University of<br>Arizona                                                                                                          | Tana River (Kenya), Station<br>Garissa (request for data of<br>1993-1997 - not available)         | Dissertation: Land use and<br>vegetation change in<br>response to river basin<br>development in the lower<br>Tana River Basin in Eastern<br>Kenya                    |
| Dr. Jonathan I. Matondo,<br>GEP Department,<br>University of Swaziland,<br>Swaziland                                                                                    | Several African Rivers<br>(request pending)                                                       | Study about the variability<br>of runoff of large African<br>Rivers                                                                                                  |
| James McManus,<br>NASA/Goddard Space<br>Flight Centre, Greenbelt,<br>U.S.A.                                                                                             | General information<br>(database catalogue)                                                       | Database catalogue for<br>general information                                                                                                                        |
| Norman L. Miller, Climate<br>& Integrated Systems<br>Atmospheric Science<br>Division, Lawrence<br>Livermore National<br>Laboratory, University of<br>California, U.S.A. | For 30 rivers, globally<br>distributed: monthly time<br>series and extreme values of<br>discharge | Research project: Large-<br>scale comparison of water<br>vapor convergence,<br>precipitation and<br>evaporation in the NCEP<br>reanalysis with monthly<br>streamflow |
| Mohamed Ali Ahmed, IHE<br>Delft, The Netherlands                                                                                                                        | 6 stations from the River<br>Nile,<br>GRDC-report No. 5                                           | Study: flow prediction with<br>an artificial neural network                                                                                                          |

| <b>Request made by<br/>(Name, country)</b>                                                                             | <b>Country or river for which<br/>data were requested</b>                           | <b>Purpose of data use</b>                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Ellyn T. Montgomery,<br>Physical Oceanographie<br>Dept., Woods Hole<br>Oceanographic Institution,<br>Woods Hole, USA   | Report No. 10 and database<br>catalogue, standard data set<br>of 160 stations       | Possible use of GRDC data<br>in the research field of<br>oceanic heat and water<br>fluxes, calculation of fluxes<br>into the Atlantic Ocean |
| Mool, ICIMOD, Kathmandu                                                                                                | Indus, Yangtse, Yellow<br>River                                                     | Project of FAO and SIDA:<br>Forestry and key Asian<br>watersheds                                                                            |
| Ragu Murtugudde,<br>NASA/GSFC, Greenbelt,<br>USA                                                                       | Discharge time series for<br>major rivers (catalogue,<br>request pending)           | Ocean model simulations                                                                                                                     |
| Nicholas O'Connor,<br>UNEP/DEIA/GRID-<br>Geneva, Chatelaine,<br>Switzerland                                            | General information about<br>environmental-related<br>databases                     | Research project:<br>Information systems with<br>respect to resolving<br>environmental conflicts                                            |
| Taikan Oki, NASA /<br>Goddard Space Flight<br>Centre, Greenbelt, U.S.A.                                                | 130 river discharge stations<br>worldwide                                           | Research project: Estimating<br>of global runoff distribution<br>(global gridded runoff)                                                    |
| Taikan Oki, NASA /<br>Goddard Space Flight<br>Centre, Greenbelt, U.S.A.                                                | 80 river discharge stations<br>worldwide                                            | Research project: Estimating<br>of global runoff distribution<br>(global gridded runoff)                                                    |
| Y. Peyvastehtar, Essen                                                                                                 | Discharge data from rivers<br>draining into the Caspian<br>Sea (database catalogue) | Dissertation: Sea level<br>changes and regional<br>planning in the Caspian Sea                                                              |
| Tan Yong Piu, Rapporteur<br>for WCP-Water,<br>Government of Signapore,<br>Met. Service                                 | Database catalogue files for<br>the countries of Oceania and<br>Australia           | Information about the<br>GRDC databases contents<br>concerning Regional<br>Association V of the WMO                                         |
| Edward V. Podgaisky and<br>Laghoali Driss, Russia State<br>Hydrometeorological<br>Institute, St. Petersburg,<br>Russia | Discharge data of 12 rivers<br>from Morocco                                         | Dissertation / diploma<br>(subject not known)                                                                                               |
| Matthias Prange, Alfred-<br>Wegener-Institut,<br>Bremerhaven, Deutschland                                              | GRDC Reports 8, 10, 12                                                              | General scientific interest                                                                                                                 |

| <b>Request made by<br/>(Name, country)</b>                                                                  | <b>Country or river for which<br/>data were requested</b>                                                         | <b>Purpose of data use</b>                                                                                                          |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Dr. Roger Proctor,<br>Proudman Oceanographic<br>Lab., Bidston Observatory,<br>Birkenhead, Merseyside,<br>UK | Data from rivers discharging<br>into the European Shelf<br>Seas, including the Baltic<br>Sea (database catalogue) | Project LOIS (Land Ocean<br>Interaction Study)                                                                                      |
| Dr. T.V. Ramachandra,<br>Indian Institute of Science,<br>Bangalore, India                                   | Database catalogue, GRDC<br>reports No. 1, 5, 9, 10, 12,<br>13, 14 and general<br>information material            | General information about<br>the availability of GRDC<br>data, data products and<br>software                                        |
| Prof. V.J. Rayward-Smith,<br>School of Information<br>Systems, University of East<br>Anglia, UK             | Ob, Yenesei, Lena                                                                                                 | Study about interaction<br>between winter precipitation<br>in Central Asia, river flow,<br>Arctic ice cover and<br>European climate |
| Liang Ren, Dept. of<br>Hydrology, Hohai<br>University, Nanjing, China                                       | General information about<br>the available GRDC data<br>sets                                                      | N.N.                                                                                                                                |
| Lars Ribbe, Fachhochschule<br>Köln, Institut für<br>Tropentechnologie, Köln,<br>Germany                     | River Barada, Syria                                                                                               | Water Resources<br>Managment in Arid Regions<br>- A Case Study of Damascus<br>Region (Diploma)                                      |
| Matthew Rodell, Dept. of<br>Geological Sciences,<br>University of Texas, Austin,<br>USA                     | 71 stations of major rivers<br>of the world                                                                       | Computation and analysis of<br>water balances over large<br>river basins of the world                                               |
| Mark W. Rosegrant and<br>Claudia Ringler,<br>International Food Policy<br>Institute, Washington,<br>U.S.A.  | Discharge data for Maipo<br>River (Chile)                                                                         | Research project: Modelling<br>of water resource allocation,<br>estimation of agricultural<br>production and others                 |
| Dr. K. Rubinstein,<br>Hydrometeorological Centre<br>of Russian Federation,<br>Moscow                        | Dataset of 160 stations (flux<br>calculation stations)                                                            | Study: Role of large-scale<br>water cycle in global climate<br>system                                                               |
| Dr. B. Rudolf, Global<br>Precipitation Climatology<br>Centre (GPCC), Offenbach,<br>Germany                  | 55 stations worldwide                                                                                             | General research purposes,<br>collaboration GRDC/GPCC,<br>precipitation/runoff<br>comparison study                                  |

| <b>Request made by<br/>(Name, country)</b>                                                                               | <b>Country or river for which<br/>data were requested</b>     | <b>Purpose of data use</b>                                                                        |
|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Cord Ruhe, International<br>Baltex Secretariat, GKSS<br>Forschungszentrum<br>Geesthacht, Deutschland                     | 7 river discharge stations<br>from Russia and Finnland        | Examination of river runoff<br>processes in the Baltex-area                                       |
| K. Schulte, University of<br>Colorado, Boulder                                                                           | Database catalogue of<br>Albania                              | General information about<br>the availability of discharge<br>data of Albania                     |
| Bernd Schwan, IUS GmbH,<br>Heidelberg, Germany                                                                           | 3 rivers from Poland                                          | Environmental Impact<br>Assessment for the German<br>Waterways and Shipping<br>Administration     |
| Bernd Schwan, IUS GmbH,<br>Heidelberg, Germany                                                                           | 9 stations from the Oder                                      | Environmental Impact<br>Assessment for the German<br>Waterways and Shipping<br>Administration     |
| Prof. Igor Shiklomanov,<br>Russia State Hydrological<br>Institute, St. Petersburg,<br>Russia                             | 3 stations from Rhein,<br>Weser, Elbe                         | Analysis of changes of river<br>runoff of the Northern<br>Hemisphere in different<br>time periods |
| Dr. Laurence C. Smith,<br>University of California,<br>Los Angeles, Dept. of<br>Geography, USA                           | GRDC Report No. 12                                            | General information                                                                               |
| Alejandro Spitzzy, Institut für<br>Biogeochemie und<br>Meereschemie, Universität<br>Hamburg, Germany                     | Database catalogue extract<br>for Malaysia                    | General information about<br>availability of gauging<br>stations in Malaysia                      |
| Ronald E. Stewart, Climate<br>Processes and Earth<br>Observation Division,<br>Atmospheric Environment<br>Service, Canada | General information about<br>GRDC                             | Presentation of GRDC in<br>meeting of GEWEX<br>Hydrological Panel (GHP)                           |
| Dr. Kevin Telmer,<br>Geological Survey of<br>Canada                                                                      | General information about<br>the availability of GRDC<br>data | Research projects about the<br>biogeochemistry of rivers                                          |

| <b>Request made by<br/>(Name, country)</b>                                                                         | <b>Country or river for which<br/>data were requested</b>                            | <b>Purpose of data use</b>                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dr. Dusan Trninic,<br>Meteorological and<br>Hydrological Service,<br>Zagreb, Croatia                               | 20 stations from the Danube<br>River basin and its<br>tributaries                    | IHP-UNESCO research<br>project: Relationship<br>between precipitation, air<br>temperature and discharges<br>over the Danube river basin                              |
| Wolfgang Vosseler,<br>Chemnitz, Germany                                                                            | Hydrological data from<br>China (database catalogue)                                 | Study: Situation of the<br>drinking water provision<br>and waste water managment<br>in China                                                                         |
| Dr. Rolf Weingartner,<br>Geographisches Institut der<br>Universität Bern, Gruppe für<br>Hydrologie, Schweiz        | 52 rivers worldwide                                                                  | Contribution for Freshwater<br>Conference of the UN<br>Commission for Sustainable<br>Development: "Mountains<br>of the world - Water towers<br>for the 21st Century" |
| Wiley, A.<br>U.S. Army Topographic<br>Engineering Centre<br>Alexandra, VA, U.S.A                                   | All rivers of Ecuador (this<br>request was approved by the<br>Government of Ecuador) | Water resources appraisal                                                                                                                                            |
| Yonkang Xue, Center for<br>Ocean-Land-Atmosphere<br>Studies, Calverton, U.S.A.                                     | Database Catalogue of East<br>Asia                                                   | Database catalogue for a<br>planned research project                                                                                                                 |
| W. F. Zimmermann,<br>Consortium for International<br>Earth Science Information<br>Network                          | GRDC catalogue                                                                       | General information about<br>international shared water<br>resources                                                                                                 |
| Dr. Franz Zunic, Lehrstuhl<br>für Wasserbau und<br>Wasserwirtschaft,<br>Technische Universität<br>München, Germany | 6 stations worldwide with<br>long time series                                        | Synthetic generation of<br>discharge time series                                                                                                                     |

## Transformation of Measured Runoff Data to Grid Points

Karlheinz Daamen

Within the framework of a national research project funded by the Federal Ministry of Education and Research (BMBF), methods for the calculation of grid-based runoff on a  $0.5^\circ \times 0.5^\circ$  grid were extended and verified for the Weser and Elbe catchments. Simultaneously, the project contributed also to the WMO WCP- Project B.3: Development of Grid-related Estimates of Hydrological Variables. Only the area-weighted runoff balancing (method 1) enables to calculate the grid-based runoff exclusively from gauge-based runoff data, although it is only applicable to areas with a high gauging station density. Data acquisition and assimilation, as well as the digitization of gauge-bases catchment limits are highly time-consuming. This method, therefore, may only be used for selected regions for which it may serve as a reference data set for the evaluation of the quality of the other methods, too.

The disaggregation of runoff by the use of statistical relationships between runoff and catchment characteristics (method 2) needs, at least at topographically more intensively structured relief, the inclusion of long-term mean areal distribution of precipitation depth. By this procedure, empirical relationships between runoff and precipitation as well as further catchment characteristics can be established. The relationships are regionally differentiated. The influence of evapotranspiration on runoff is not explicitly taken into consideration within the computational scheme. Therefore, this method was not further investigated within the project.

With respect to a possible continent-wide applicability, the water balance model of Thornthwaite-Mather was extended. The model WABIMON enables the calculation of long-term mean grid based runoff using the existing global hydrometeorological and physiographic data sets. Combined with the monthly means of runoff at selected reference gauges, the time-dependent grid-based runoff can be calculated.

Improvements in future projects have to be done in the model components of the water balance model, especially the parameterization of runoff coefficient, and in the selection criteria of the reference gauges. For this task, the runoff data of the Global Runoff Data Centre (GRDC) and the precipitation data (Rudolf et al., 1992) of the Global Precipitation and Climatology Centre (GPCC) of Europe are foreseen for evaluation. Method 3 forms the basis for the calculation of timely monthly overviews of grid-based runoff planned by the GRDC.

The project has finished at the end of 1995. The results have been documented in a report (BfG, 1997).

### References

BfG (1997): Übertragung von gemessenen Abflußwerten auf Gitterpunkte, BFG-1062, Koblenz.

Rudolf, B., Hauschild, H., Reiss, M. & Schneider, U. (1992): Die Berechnung der Gebietsniederschläge im  $2,5^\circ$ -Raster durch ein objektives Analyseverfahren. *Meteorologische Zeitschrift* **1**, S. 32-50.

## The Development of a GIS-supported Water Balance Model as a Tool for the Validation of Climate Models and Hydrometeorological Datasets

P.Krahe

A monthly water balance model is currently in development at the BfG which shall be used for continental hydrologic modelling with respect to climate models (GCM's) and the development of global water resources.

The following applications of the Water Balance Model are carried out or planned in the future:

- \* Estimation of monthly gridded runoff on continental scale in combination with discharge data stored in the GRDC
- \* Test of consistency and homogeneity of discharge data stored in the GRDC
- \* Verification of model parameter of hydrological models used in global and regional climate models and development of parameter estimation techniques using measured discharge data and GIS-datasets
- \* Reliability of gridded global precipitation and meteorological data sets derived from measured data
- \* Verification of water balance components of global and regional climate models
- \* Study of availability of water resources and their possible change in regard of global greenhouse warming

The water balance model applied is a variation of a scheme which was first proposed by Thornthwaite and Mather (1957) and subsequently has been transposed in today's notation with slight modification by Vörosmary et al. (1989). Improvements with regard to the production of direct and delayed runoff are introduced in the previous schemes. To run the model gridded rainfall and temperature data are needed. Soil and landuse data stored in a Geographical Information System are used for the calculation of model parameters.

The model was applied for Central Europe using a rainfall dataset of GPCC within the project "Transformation of Measured Runoff Data to Grid Points" (BfG, 1997) and verified for the German catchment areas of the rivers Danube, Rhine, Weser, and Elbe. The results indicate that the model can be used for the estimation of monthly gridded runoff if measured discharge data are used for correction of errors related to the model and the rainfall- resp. temperature data.

The model is very sensitive against the quality of the rainfall data. Therefore it can be used to test the reliability of gridded global meteorological especially rainfall datasets derived from measured data as well the output of climate models. An example is given by Krahe and Grabs (1996) for Central Europe using a rainfall dataset of GPCC.

Beside the simple structure of the model, it can also be used to test the reliability of presently available global datasets of soil and landuse parameters to simulate the hydrological cycle in climate models. The studies have shown that an improvement of estimation techniques for parameters of runoff production in continental hydrological models is necessary. The activities of the BfG are concentrated on the development of parameter estimation techniques for recession coefficients of baseflow based on geological and hydrogeological maps (Krahe et al., 1997).

The applications of the model have already shown that some further developments of the water balance model are needed. The parameterization of the runoff coefficient to model the effect of

infiltration excess runoff will be improved using an extended precipitation climatology and a probability-distributed soil moisture storage.

In further studies a validation and verification of the Water Balance Model is planned for the whole territory of Europe using the discharge data stored in the GRDC and precipitation datasets of GPCC.

#### Literature

BfG (1997): Übertragung von gemessenen Abflußwerten auf Gitterpunkte, BfG-1062, Koblenz

Krahe P. and W. Grabs (1996): The Development of a GIS-supported Water Balance Model as a Tool for the validation of Climated Models and Hydrometeorological Datasets. WMO/IAHS Workshop on Continental Scale Hydrological Models: Charting the Future, 11-13 November 1996, Wallingford

Krahe P., K-H. Daamen, R. Mülders and K. Wilke (1997): GIS-related baseflow simulation for water balance and precipitation-runoff modeling in the River Rhine basin. IAHS Publication no. 242

Thornthwaite, C.W. and J.R. Mather (1957): Instructions and tables for computing potential evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology, Publications in Climatology, 10, (3), Centeron, New Jersey

Vörösmarty C.J., B. Moore III, A.L. Grace, et al. (1989): Continental Scale Models of Water Balance and Fluvial Transport: An Application to South America. Global Biogeochemical Cycles, Vol. 3, No. 3, 241-265

## **Statistical evaluation of European and selected world-wide GRDC stations discharging into the oceans**

Felix Portmann

The principal objectives for the statistical analysis of streamflow into the oceans are: The validation of computed runoff into the oceans derived from global circulation models (GCM), the variability of these flows, possible changes in Arctic Ocean water budget and the thermohaline circulation in the Oceans, especially the Atlantic Ocean in order to simulate accurately possible climate changes and their impacts on changes of climate zones and the transport of matter into the oceans. Within this context, an indication of possible jumps and trends can help to identify the impact of medium-term climate variations, e.g. relatively much or less rainfall induced by increased or decreased anticyclonic activity during a certain historical period of time.

With this scope in mind, a selection of GRDC monthly time series of 22 European and 11 Non-European stations, within the period 1805 until 1996, was statistically evaluated by the use of publicly available programmes. The programmes were developed for the WCP-Water Project A.2 of WMO, as HOMS (Hydrological Operational Multipurpose System)-component by Czech Hydrometeorological Institute CHMI and for a project financed by the European Union by the Ruhr-Universität Bochum (RUB).

The statistical methods and the results, as well as a short interpretation of the results will be published in a forthcoming GRDC report.

Although the total period covered is from 1807 up to 1996, most series are shorter and start in the first half of this century. To cope with sometimes present missing values, in the case of very short time series gaps were closed either by the mean of the respective month or by statistically significant linear regression with data from adjacent months.

Most of the series are distributed according to normal distribution, in 3 cases in Europe according to log-normal distribution, in 1 case of a Siberian station no successful transformation was possible, due to sometimes extremely low discharge in comparison with mean discharge.

The basic statistics were calculated by the programmes of WMO and CMHI.

The range of the discharge is from 7 m<sup>3</sup>/s up to 30600 m<sup>3</sup>/s mean discharge and a mean discharge per unit area of 0.2 l/(s\*km<sup>2</sup>) up to 36.6 l/(s\*km<sup>2</sup>). Annual minimum is 5 m<sup>3</sup>/s, annual maximum 37100 m<sup>3</sup>/s, while the absolute monthly minimum and maximum are 0 m<sup>3</sup>/s and 112000 m<sup>3</sup>/s, respectively.

Jumps and trends were analysed mainly with the programmes of CHMI and RUB.

Jumps are observed only rarely in annual series, at 6 European stations and perhaps only 1 non-European station.. If observed, they mostly occur in the 1960ies and 1970ies, while for most of the series no association with the installation of large dams in the river basin was possible. For Northern Europe, such jumps occur first between the years 1962/63, 1967/68 and 1978/79. In Southern

Europe, 1962/63, 1966/67 and 1972/73/74 are the respective years. A relationship with dam completion are possible for the Spanish River Jucar for jumps in 1954/55 (dam completion in 1956), but not in 1935/36 (no dam). Jumps in the series of individual months may be present when the annual series does not show any significant jump.

Trends are observed for the annual series for most of the series. However, as a rule, the longer the series, the smaller are the trends. The respective correlation coefficients are small in most cases. For the longest series, the yearly decrease or increase in percentage of the series' mean is only 0.15 % as a maximum value, while the correlation coefficients are small, with explained variance ( $R^2$ ) of only 1 to 5 %.

| Region          | River          | Time series | Mean discharge<br>[m <sup>3</sup> /s] | Slope of trend<br>[m <sup>3</sup> /s*year] | Slope/mean<br>[%] | R     |
|-----------------|----------------|-------------|---------------------------------------|--------------------------------------------|-------------------|-------|
| Central Europe  | Loire          | 1863-1979   | 838                                   | +1.22                                      | 0.15              | 0.15  |
| Northern Europe | Vaenern-Goeta  | 1807-1992   | 534                                   | -0.19                                      | 0.04              | 0.10  |
| Northern Europe | Northern Dvina | 1882-1985   | 3315                                  | -4.65                                      | 0.14              | -0.22 |

Nevertheless, for sub-series significant trends are observed at the end of the series, mostly starting in the 1970ies. For rivers in Europe and Siberia, the trends cannot be associated to dams construction in most cases. The strongest trends normally start in 1969-1970 or 1976-1977, only in exceptional cases in 1953 and 1986. The effect of dams might be induced for trends of River Orinoco for a starting in 1981 (dam in 1982), and of River Paraná in 1968 (dam in 1968). As for jumps, significant trends in the series of individual months may be present when the annual series does not show any significant trends.

**Commented Status of Membership in the GRDC Steering Committee**  
**Status: 11/1997**

Annex 9

| Member              | Status               | Affiliation with GRDC                            | Remarks                                                                                                                                                                                      |
|---------------------|----------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WMO                 | Institutional Member | OHP, WHYCOS, WCP-Water, WCRP                     | GRDC is technically guided through Hydrology and Water Resources Division (HWRD) of WMO                                                                                                      |
| UNESCO              | Institutional Member | IHP                                              | Cooperation with IHP-related programmes, especially FRIEND                                                                                                                                   |
| UNEP/WHO            | Institutional Member | GEMS/Water                                       | Cooperation with GEMS collaborating data centre on water quality; cooperation in water-related programmes of UNEP and WHO                                                                    |
| World Bank          | Institutional Member | Development of global water strategies, projects | WB has not yet attended a GRDC Steering Committee meeting. GRDC has visited World Bank on several occasions, contacts are continuing on individual levels                                    |
| ICSU                | Institutional Member | GEWEX, Science programmes                        | The Director, WCRP had been nominated by ICSU to represent ICSU in the 3rd GRDC-Steering Committee meeting                                                                                   |
| GPCC                | Institutional Member | Global Data Centre                               | Collaboration with GRDC in science projects, especially gridded data products                                                                                                                |
| Government of Japan | Government           | Special Arrangement                              | Japan is a key player in water-related bi-lateral assistance in Asia. There is an underrepresentation of Asia in science, technology and water-related programmes in GRDC-related activities |
| H.-J. Liebscher     | Individual Member    | Chairman, GRDC                                   | Nominated by WMO                                                                                                                                                                             |
| K. Wilke            | Individual Member    | Head of Section, FIH                             | Nominated by Federal Institute of Hydrology, Koblenz                                                                                                                                         |
| Z. Kaczmarek        | Individual Member    | Head of Hydromet. Service, Poland                | Nominated by WMO                                                                                                                                                                             |
| WMO/CHy             | Ex-Officio           | Working Groups Hydrology                         | Direct links in terms of policy issues and general operation of GRDC in the interest of CHy, link function to Congress                                                                       |
| GHP                 | Ex-Officio           | GEWEX Hydrometeorological Panel                  | Direct link to WCRP, GEWEX and Continental Scale Experiments in the context of GEWEX                                                                                                         |
| FRIEND              | Ex-Officio           | Cooperation with IHP                             | Direct operational links with regional FRIEND projects; representation of FRIEND by Institute of Hydrology, Wallingford (European Water Archive)                                             |
| President, FIH      | Observer             | Chief Administrator, host for GRDC               | Key person in terms of GRDC financial and manpower resources support provided by the government of Germany                                                                                   |
| Ad-hoc              | Observer             | On special invitation                            | Invitations for discussions e.g. of programmes, science projects, advisory services                                                                                                          |
| W. Grabs            | Secretary, GRDC      | Head of GRDC                                     | Implementation of recommendations of the Steering Committee                                                                                                                                  |

## Reference of GRDC Reports

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- Report No. 1**      Second Workshop on the Global Runoff Data Centre, Koblenz,  
(May 1993)      Germany, 15 - 17 June, 1992.
- Report No. 2**      Dokumentation bestehender Algorithmen zur Übertragung von  
(May 1993)      Abflußwerten auf Gitternetze. (Incl. abstract in English by the  
GRDC: Documentation of existing algorithms for transformation  
of runoff data to grid cells) by G.C. Wollenweber.
- Report No. 3**      GRDC - Status Report 1992.  
(June 1993)
- Report No. 4**      GRDC - Status Report 1993.  
(June 1994)
- Report No. 5**      Hydrological Regimes of the Largest Rivers in the World -  
(November 1994)      A Compilation of the GRDC Database.
- Report No. 6      Report of the First Meeting of the GRDC Steering Committee,  
(December 1994)      Koblenz, Germany, June 20 - 21, 1994.
- Report No. 7**      GRDC - Status Report 1994.  
(June 1995)
- Report No. 8**      First Interim Report on the Arctic River Database for the  
(July 1995)      Arctic Climate System Study (ACSYS).
- Report No. 9**      Report of the Second Meeting of the GRDC Steering Committee,  
(August 1995)      Koblenz, Germany, June 27 - 28.
- Report No. 10**      Freshwater Fluxes from Continents into the World Oceans based on  
(March 1996)      Data of the Global Runoff Data Base.
- Report No. 11**      GRDC - Status Report 1995.  
(April 1996)
- Report No. 12**      Second Interim Report on the Arctic River Database for the  
(June 1996)      Arctic Climate System Study (ACSYS).
- Report No. 13**      GRDC Status Report 1996  
(Februray 1997)

Reference of GRDC Reports

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- Report No. 14**      The use of GRDC - information  
(February 1997)      Review of data use 1993/1994. Status: January 1997
- Report No. 15**      Third Interim Report on the Arctic River Data Base (ARDB) for the Arctic  
(June 1997)          Climate System Study (ACSYS): Plausibility Control and Data Corrections  
                                 (Technical Report)
- Report No. 16**      The GRDC Database. Concept and Implementation.  
(August 1997)
- Report No. 17**      Report on the Third Meeting of the GRDC Steering Committee, Koblenz,  
(Sept. 1997)          Germany June 25-27, 1997

| <b>List of Acronyms used in this Report</b> |                                                                                                                                   |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| ACSYS                                       | Arctic Climate System Study                                                                                                       |
| ARDB                                        | Arctic River Database                                                                                                             |
| CHMI                                        | Czech Hydrometeorological Institute                                                                                               |
| CSE                                         | Continental Scale Experiment (within GEWEX-GHP)                                                                                   |
| DMIP                                        | Data Managment and Information Panel (within ACSYS)                                                                               |
| ESCAP                                       | Economic and Social Commission for Asia and the Pacific                                                                           |
| EU                                          | European Union                                                                                                                    |
| FIH                                         | Federal Institute of Hydrology, Koblenz, Germany                                                                                  |
| FRIEND                                      | Flow Regimes from International and Experimental Network Data                                                                     |
| GCOS                                        | Global Climate Observing System                                                                                                   |
| GEMS/Water                                  | Global Environment Monitoring System                                                                                              |
| GEWEX                                       | Global Water and Energy Cycle Experiment                                                                                          |
| GHP                                         | GEWEX Hydrometeorological Panel                                                                                                   |
| GPCC                                        | Global Precipitation Climatology Centre                                                                                           |
| GTOS                                        | Global Terrestrial Observing System                                                                                               |
| HKH-FRIEND                                  | Hindu-Kush-Himalaya FRIEND (see FRIEND)                                                                                           |
| HOMS                                        | Hydrological Operational Multipurpose System                                                                                      |
| IGBP-LOICZ                                  | International Geosphere-Biosphere Project: Land-Ocean Interaction in the Costal Zone                                              |
| IHP                                         | International Hydrological Programme (of UNESCO)                                                                                  |
| INTAS                                       | International Association for the promotion of cooperation with scientists from the independant states of the former Soviet Union |
| Med-HYCOS                                   | Mediterranean Hydrological Cycle Observing System (within WHYCOS)                                                                 |
| NOAA                                        | National Oceanic and Atmospheric Administration                                                                                   |
| OHP                                         | Operational Hydrological Programme (of WMO)                                                                                       |
| ORSTOM                                      | L'Institut français de recherche scientifique pour le développement en coopération                                                |
| RUB                                         | Ruhr-Universität Bochum                                                                                                           |
| SADC-HYCOS                                  | South African Development Commission Hydrological Cycle Observing System                                                          |
| UN                                          | United Nations                                                                                                                    |
| UNEP                                        | United Nation Environmental Programme                                                                                             |
| UNESCO                                      | United Nations Educational, Scientific and Cultural Organization                                                                  |
| WCP-Water                                   | World Climate Programme Water                                                                                                     |
| WHO                                         | World Health Organisation                                                                                                         |
| WHYCOS                                      | World Hydrological Cycle Observing System                                                                                         |
| WMO                                         | World Meteorological Organisation                                                                                                 |