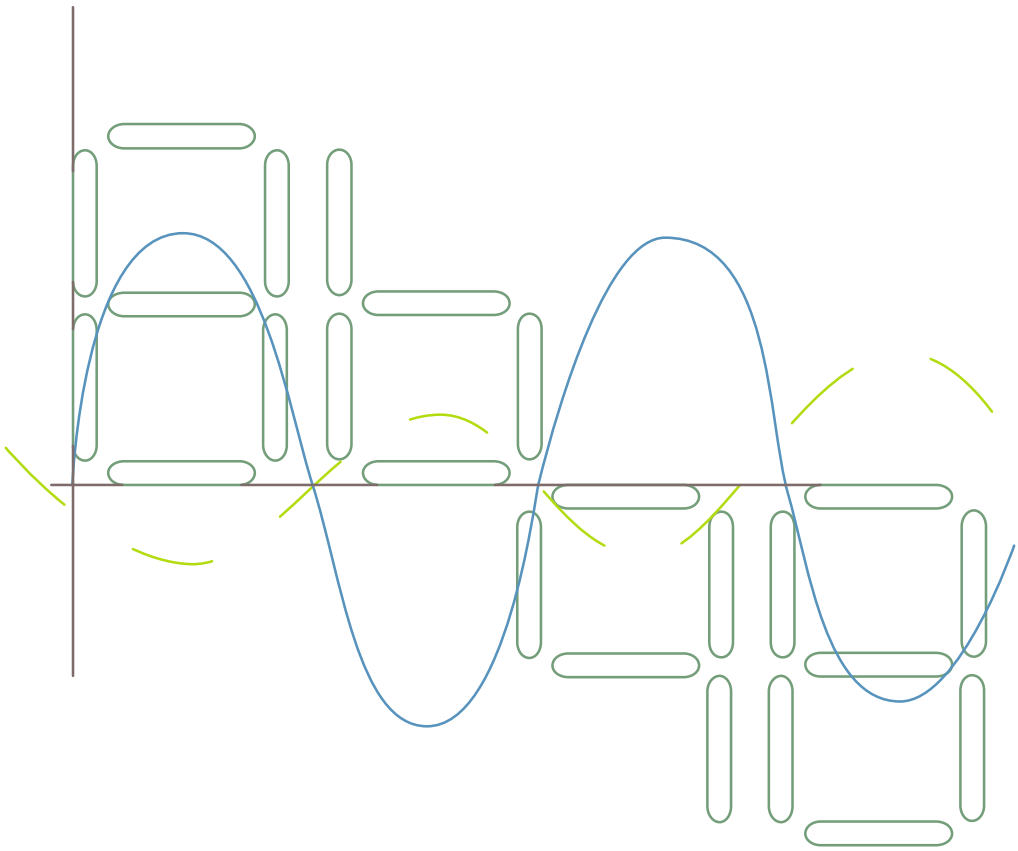
Report 34

GRDC Report Series

Sixth Meeting of the GRDC Steering Committee

11-13 June 2003, Koblenz, Germany



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Global Runoff Data Centre

GRDC operates under the auspices of the World Meteorological Organization (WMO) with the support of the Federal Republic of Germany within the Federal Institute of Hydrology (BfG)

Global Runoff Date Centre

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March 2005

Contents

Annexes

This report is accompanied by a CD-ROM including the digital annex, alternatively available also from the GRDC ftp-Site at ftp://www.bafg.de/pub/REFERATE/GRDC/GRDC_SC_6.

Report of the 6th Meeting of the GRDC Steering Committee

11 -13 June 2003, Koblenz, Germany

Executive summary

The international Steering Committee (SC) of the GRDC met for its 6th meeting from 11 to 13 June at Koblenz, Germany.

The SC reviewed the past activities and developments of both the GRDC and related international organisations, programmes and projects. From that perspective SC discussed the strategic development of GRDC activities, implementation goals as well as priorities.

SC noted with appreciation progress made with many action items defined in the previous 5th SC meeting 2001, notably:

- Intensification and systematisation of data acquisition activities;
- Attraction of indirect additional resources by GRDC's new practice to foster collaborations with data users, that result in joint reports published in the GRDC Report Series;
- GRDC's active participation in the Global Terrestrial Network for Hydrology (GTN-H),
- Design of a new GRDC homepage, including extensive reporting on database status, recent data provisions, database usage and reference to publications on scientific research supported by GRDC data;
- Formulation of an information note on GRDC station selection criteria;
- Participation in many conferences and workshops, including poster-presentation at the 3rd World Water Forum in March 2003 in Japan and the collaboration in the authoring team of the Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC (2AR).

SC made a couple of suggestions to GRDC, including:

- to systematically address the Permanent Representatives of a country to WMO and their Hydrological Advisors with respect to data acquisition, possibly supported by the WMO HWRP Secretariat;
- to produce a technical note on current GRDC river discharge data plausibility check procedures and to consider the development of an integrated stand-alone software for this purpose, which could be freely distributed to data providers and serve as an incentive to deliver more data in a timely fashion;

- to collaborate closely with the experts of the working groups of the Commission for Hydrology, CHy, especially with respect to metadata and QA/QC issues;
- to continue collaboration with GCOS, especially in the extension of the 2AR to the GCOS Implementation Plan;
- to foster joint marketing of GRDC, GEMS/Water, GPCC and IGRAC programs and to eplore options to collaborate on a more institutionalised level. Specific suggestions were to produce joint flyers and letters, as well as to plan to hold a workshop with global focus on joint GRDC-GPCC and joint GRDC-GEMS/Water products on rainfall-runoff cross-validation and biogeochemical fluxes, respectively;
- to ensure GRDC's continued collaboration and involvement in relevant international research and operational programmes and projects such as GEWEX, CliC, GCOS, GTN-H, WHYCOS etc.;
- to proactively advance the topic of metadata by writing up a report on the metadata issue, developing a concept, discussing this in the GTN-H panel and in expert groups, developing in the framework of a pilot study a prototype, that demonstrates the advantages and capabilities;
- to actively extend its contribution to the Global Terrestrial Network for Hydrology (GTN-H), especially by developing the GRDC Near-Real-Time River Discharge Monitor;
- to try to attract additional temporal staff by e.g. working with students and PhD candidates or seconded experts, send from their home organisations to GRDC;
- to explore possibilities to scan earlier GRDC reports and make them available via the GRDC homepage;
- to publish its contacts (address database of data providers and users) on the GRDC web page;
- to explore options to ensure a security copy of the GRDC database to reside at WMO/HWRD.

0 General

As always during the SC meeting the past activities and developments of both the GRDC and related international organisations, programmes and projects were reviewed. From that perspective the strategic development of GRDC activities and its priorities have been discussed.

This report (with exception of this section 0) follows the enumeration of the agenda as given in Annex 1 respectively the provisional annotated agenda in Annex 2.

The membership of the Steering Committee by organisations or group is given in Annex 3, the list of attendees in Annex 4 and the list of GRDC staff members in Annex 5.

The MS PowerPoint presentations given during the meeting as well as other related electronic material is provided on a CD ROM attached to the printed copy of this report as well as by the GRDC ftp-Site (ftp://www.bafg.de/pub/REFERATE/GRDC/GRDC_SC_6). A list of all these files is given in Annex 9. Throughout this report this material is referenced by "digital annex, agenda item" followed by the number of the agenda item.

In the electronic version of this report it is possible to click on cross-references to internal links including the annexes as well as to http-links and the associated ftp-directory of the digital annex, if internet connection is available.

1 Opening of the meeting by the chairman

The 6th meeting of the GRDC-SC was formally opened by the chairman of the GRDC Steering Committee, Mr Klaus Wilke followed by the welcome address of Mr. V. Wetzel, Professor and Director of the Bundesanstalt für Gewässerkunde (BfG, Federal Institute of Hydrology) that hosts the GRDC .

2 Organisation of work and adoption of the agenda

All member organisations of the GRDC SC (Annex 3) sent at least one representative with the exception of UNESCO/IHP, which instead provided a presentation on HELP compiled by Ms Camille Talayssat, which was presented on her behalf by Mr Gywn Rees.

The agenda of the meeting (Annex 1, see also the annotated agenda in Annex 2) was discussed and adopted without changes.

3 GRDC at the Federal Institute of Hydrology: review and perspectives for development

The Director of the Federal Institute of Hydrology, Mr Wetzel, presented a review of the inputs provided by BfG (http://www.bafg.de) for GRDC for which the Federal Ministry for Transport and Housing (http://www.bmv.de) provides the core funding. Funding includes staff salaries, provision of office space and office infrastructure as well as data processing facilities and support of travel of GRDC staff (see digital annex, agenda item 3).

After there has been a significant increase of funding during the years 1994 to 1998 the support of the GRDC has been more or less constant during the recent years. This has to be seen as a success, as annual budgets of public services have been reduced in recent years.

GRDC currently operates with 4 permanent staff-members, i.e. 2 academics and 2 technicians. From dedicated BfG resources, 3 additional part-time staff contribute to GRDC's work, totally equivalent to approximately one more person. According to Mr Wetzel, given the current economic situation of the Federal Government and thus the obligation to continue decreasing BfG staff, it is unlikely that GRDC staff can be increased in the foreseeable future based on regular federal funds. However he conceded the possibility to slightly increase travel-budget in future.

4 GRDC activities, status and development

During the meeting the members of GRDC staff gave presentations of the various aspects of GRDC work, featuring the following topics:

Ag. Item	*Topic*	*Presented by*
4.1	Homepage and public relations	Maurer
4.2	GRDC Data Acquisition and GRDC Database Status	Dornblut
4.3	Data dissemination and GRDC Database Usage	Lüllwitz
4.4	Development of the database management system	Pauler
4.5	Data products	
4.5.1	Long Term Mean Annual Freshwater Surface Water Fluxes into the World Oceans	de Couet
4.5.2	Long Term Mean Monthly Discharges and Annual Characteristics of Selected GRDC Stations	Maurer
4.6	GRDC Reports & Publications	Maurer

The summary of the presentations is available from section 4 of the annotated agenda in Annex 2. Furthermore, some presentations are available from the digital annex sources. Partly, presentations were given as an online tour through sections of the draft new GRDC homepage, which was already available at the BfG intranet at the time of the SC meeting (since June 2004 the GRDC homepage is online at http://grdc.bafg.de).

Related to the new GRDC homepage introduced under agenda item 4.1, SC suggested to explore possibilities to scan earlier GRDC reports and make them available via the GRDC homepage. SC further recommended to continue efforts of GRDC to publish its contacts (address database of data providers and users) on the GRDC web page.

Related to agenda item 4.2 and problems with data acquisition discussed under this topic, Mr Rees questioned the suitability of the GRDC data selection criteria (http://grdc.bafg.de/?916). He made the point, that they might be too complex to be easily understood. Mr Kinosita suggested to contact directly the Hydrological Advisor of the WMO Permanent Representative of a country. Mr Fraser stressed, that insufficient funding always constitutes a constraint with regard to data acquisition. Mr Liebscher referred to WMO Resolution 25 (Cg-XIII 1999) and suggested to refer to it again in an official letter by the WMO Secretary General. Mr Grabs affirmed this suggestion, but at the same time stressed the need for project oriented data acquisition. Discussing the potential use of financial incentives, Mr Rees was of the opinion, not to pay for discharge data and not even for the digitalisation of available analogue data records as done by the GRDC in the case of Russia. Mr Rudolf mentioned GPCC experience of more successful data acquisition if data provision is restricted to projects and not redistributed, as it is the case for GPCC. He also repeated his experience with official letters of WMO, which by and large were not very successful as compared to personal acquisition contacts, which he rated the best way of acquisition.

Related to the discussion on data dissemination under agenda item 4.3 Mr Ryabinin was interested in the total amount of data in Mbyte. The GRDC database requires around 2 Gbyte of storage, which nowadays does not constitute specific data management problems, in contrast to the beginnings of GRDC operation. Furthermore, the distribution of data usually can be done easily by attaching a compressed database extraction to emails. Mr Rees asked for the possibility for free download of GRDC data. Though technically not a problem this option is not offered, as it would contradict the GRDC data policy (http://grdc.bafg.de/ ?917).

Mr Fraser stressed the importance of the identification and registration of the purpose of a data request.

Related to the discussion of the development of the database management system under agenda item 4.4 the issue of near-real-time data acquisition came up. Mr Grabs mentioned its importance, especially in the context of the GTN-H project (see section 6.4). Mr Rees pointed to the problem, that often only *stage* data are available in near-real time.

Mr Grabs brought up the issue of storing a copy of the GRDC database at WMO. There was some discussion on the purpose of such a copy. Mr Wellens-Mensah recommended to store a simple back-up copy for data security only. The following options exist principally:

(1) Rudimentary backup of the GRDC database: Export of one ASCII-File for each time series of each GRDC station (currently (Feb 2005) 4700 files of original daily data and 5600 files with original monthly data) and extended GRDC Metadata table.

Pros: Contains all relevant data, does not require specific software, no large efforts required at GRDC
Cons: Not comfortably accessible

(2) Full functioning mirror of the GRDC database:

Server Software: ORACLE 9i
- GRDC database export from BfG's ORACLE 9i server to be reimported to a ORACLE 9i database at WMO
- Installation of an ORACLE-made ODBC driver at a WMO client

Client software: GRDC basetool written in BORLAND's DELPHI ENTERPRISE 7
- Requires the installation of the Borland Database Engine (BDE)
- Definition of some aliases in the ODBC environment

Pros: Gives full query functionality as used in the GRDC; no large efforts required at GRDC
Cons: Requires specific database software and application skills

(3) Development of a demo application

Reorganisation of a part of the GRDC database and creation of a stand-alone application to be run from a CD-ROM or DVD, e.g.
- by using standard web software technology together with a freeware database like MySQL and PHP-Scripts
- by developing a shell around a DBASE export of parts of the GRDC database

Pros: Intuitive, easy-to-use user interface, potentially useful as an incentive to data providers.
Cons: Comparatively large programming efforts required, cannot be provided by GRDC in due time. For this option it is recommended to hire a software developer. Who could provide the funds?

No final decision was made. The issue will be put on the agenda again during the next SC meeting.

Regarding the presentation on "Long Term Mean Annual Freshwater Surface Water Fluxes into the World Oceans" under agenda item 4.5.1, Mr. Ryabinin inquired about the difference between results of GRDC and Shiklomanov. The general results are comparatively similar, however the spatially distributed results differ occasionally significantly as will be

demonstrated in the forthcoming GRDC report. Mr. Maurer explained the lack of data in some regions of the world (e.g. Indonesia, Chile) and the fact that not all stations provide data for the entire time series span 1961-1990 considered in this study. Mr Liebscher mentioned an IAHS workshop on the global water balance. Mr Grabs expressed optimism that in mid term the data situation will improve, as current activities as e.g. the Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC (2AR) will hopefully trigger some improvements and will help to acquire updates, at least for some key stations, ideally in near real-time. Mr Wilke stressed that the method applied is a straight forward and fast method, applying a simple rainfall-runoff model and thus only applicable for average conditions.

5 WMO and CHy WG activities relevant to the work of the GRDC

Mr Grabs provided the SC with GRDC relevant news from WMO Congress (Cg XIV, 5–24 May 2003), Executive Council (EC 54, 11–21 June 2002 and EC 55, 26–28 May 2003) and the CHy Advisory Working Group meetings. Annex 6 provides extracts from the most relevant passages from agenda item 3.5 (Hydrology and Water Resources Programme, HWRP) of the abridged final report of Cg XIV, which can be summarised as follows:

WMO has a new subtitle: "Weather, Climate and Water" which will also help the recognition of the importance of GRDC, as "Water" now is explicitly mentioned.

Concerning the WMO/UNESCO Water Resources Assessment - Handbook for the Review of National Capabilities it is planned to focus attention on obtaining concrete deliverables through projects, two of which were associated with advanced basic systems. The first was directed to increasing the ability of Members to acquire real-time quality-controlled estimates of water levels and discharges using advanced technologies, while the second was directed to the identification of metadata for hydrological data, including mechanisms for the provision, display and access to the metadata.

Concerning the WMO Guide to Hydrological Practices, Congress strongly recommended that the sixth and future editions of the Guide should be made available both for free downloading from the Internet and on CD-ROM, to be distributed free of charge to Members.

Concerning the Hydrological Information Referral Service INFOHYDRO a review and revision of the contents and scope of INFOHYDRO is envisaged, with the objective of retaining most of the valuable information contained in previous editions, while at the same time making it easier for Members and the Secretariat to update the information using metadatabase standards, preferably in an online mode. Mr Grabs informed the SC about INFOHYDRO temporarily being taken off the WMO web site, as it is outdated and the response for updates currently is poor.

Congress further noted the efforts through the Global Terrestrial Network for Hydrology (GTN-H) to establish a reference hydrometric network that would serve to understand better climate change impacts on hydrological regimes.

Concerning the Global Runoff Data Centre (GRDC) itself, Congress noted with appreciation that the GRDC had continued to be recognised as an important source of data on river flow. Congress recalled that the need for data and information on the availability and use of fresh water was identified by the United Nations General Assembly at its special session in June 1997 and discussions on the role of GRDC saw this as an important pointer to the future.

Congress noted with interest the ongoing activities by GRDC and collaborating partners to identify a network of hydrological stations world-wide from which data could be accessed in near real-time and regularly through the Internet and encouraged GRDC to strive to release a prototype version as early as possible.

Congress urged GRDC to continue production of scientific reports on global hydrological issues and to strengthen its efforts to obtain data from Members more timely.

Congress also noted with concern that, in many cases, the transfer of hydrological data from Members to the GRDC had taken several years and urged Members to make discharge data available to GRDC in an institutionalised and timely manner.

Recognising the importance of the services provided by GRDC, Congress decided to keep in force Resolution 21 (Cg-XII).

During the discussions within the SC it was mentioned that for long time there has been the vision of a baseline network of around 1000 river discharge stations providing near real-time data. While originally it was hoped to establish this network based on WHYCOS data, GTN-H (see also section 6.4) will now provide a new framework to achieve this goal. Data from already operating HYCOS are planned to be harvested by the system, that will be developed in the framework of GTN-H.

SC was informed about Mr Kaneki, CHy working group expert on metadata, having moved to a new position and thus being unable to continue his service for the WG. He will be substituted by a successor. He had been distributing a questionnaire on data exchange to world-wide NHS, but received only a small response, 39 % of which indicated that they do exchange data.

Mr Kinosita provided the SC with a proposal for river discharge metadata as currently discussed to be introduced in Japan (see Annex 7). In addition to the standard metadata entries already available in the GRDC database it lists among others the following suggestions: topography, flow regime, gauge type, observation principle, procedure applied for data checking, rating curve, tidal influence, diversion upstream, reservoir upstream, water release from hydropower.

Mr. Kinosita also provided the SC with an information note on river discharge quality assurance (QA, see Annex 8, see also section 11), which – as he stressed – has two aspects: QA at the gauging site and QA in the data base. He also stressed the need to improve the sections on accuracy of discharge data in the WMO Guide to Hydrological Practices.

6 Status of and opportunities for GRDC co-operations in UN-Projects and Programmes

6.1 WCRP, GEWEX, CEOP, ISLSCP, ACSYS, CliC

The World Climate Research Program (WCRP, http://www.wmo.ch/web/wcrp/wcrp-home.html) is a joint Programme of WMO, ICSU and IOC of UNESCO coordinating a couple of Projects, among them GEWEX and ACSYS.

There are various GRDC activities in the framework of the Global Energy and Water Cycle Experiment (GEWEX, http://www.gewex.org/). A summary is available from section 6.1.1 of the annotated agenda in Annex 2.

The Arctic Climate System Study (ACSYS, http://acsys.npolar.no/), being the only regional programme of WCRP, was initially implemented around 1994 and is currently supported until the end of 2003. A successor project, the Climate and Cryosphere (CliC, http://clic.npolar.no/) has been implemented as a global programme. ACSYS and CliC are two projects that are managed by one Scientific Steering Group (SSG). The GRDC constructs the ARDB (http://ardb.bafg.de) on behalf of ACSYS. A summary is available from section 6.1.2 of the annotated agenda in Annex 2.

Mr. Vladimir Ryabinin gave a presentation on issues related to GEWEX and CliC (PPT-file in digital annex, agenda item 6.1). These are the conclusions of the presentation with respect to GRDC:

- GRDC is considered by GEWEX, ACSYS/CliC as an important element of the projects' activities;
- WCRP is interested in proactive position of the GRDC in its "hunt" for data. It is ready to support such activities if required;
- There is a role for GRDC in ISLSCP-II (and III?) and a bright future for both data and model based run-off estimates;
- WCRP has to ensure that GRDC obtains CEOP reference site data and collaborates with the producers of MOLTS (Model Output Location Time Series);
- WCRP supports GRDC work with all Continental Scale Experiments and the affiliated experiments;
- The transition of the Arctic Runoff Data Base (ARDB) to the CliC Runoff Data Base (CRDB) is desirable;
- Hydrology of frozen ground region under climate change provides additional opportunities for GRDC collaboration.

GRDC contributes its data to the Global Soil Wetness Project 2 (GSWP-2), which is an ongoing environmental modelling research activity of the Global Land-Atmosphere System Study (GLASS) and the International Satellite Land-Surface Climatology Project (ISLSCP), both contributing projects of GEWEX.

SC reinforced its view that GEWEX Continental Scale Experiments (CSE) should provide their discharge data to GRDC.

Concerning CEOP reference sites it was pointed out that out of 36 reference stations, only 4 have suitable hydrological information, namely Tibet (China), Niamey (Niger), Oumé (Ivory Coast), Berms (Canada). SC recommended to store discharge data made available by CEOP in the GRDC database.

6.2 WHYCOS

SC was briefed about the goal of the World Hydrological Cycle Observing System WHYCOS (http://www.wmo.ch/web/homs/projects/whycos.html) to eventually arrive at a network of approximately 1000 stations around the globe that deliver hydrological and meteorological as

well as environmental quality data. The current concept is the development and implementation of regional HYCOS projects addressing specific needs of the regions involved. This regional approach makes it easier to secure funding for the projects. All regional HYCOS projects, however, are implemented under a global perspective and ultimate global exchange of the data and information generated in the regional projects. The various HYCOS projects feature different levels of development, the most advanced ones being MED-HYCOS (Mediterranean Sea), AOC-HYCOS (Central and West Africa) and SADC-HYCOS (Southern Africa).

SC expressed the view that each HYCOS is obliged to forward its data to the GRDC. However, data exchange with HYCOS projects is not straightforward, as e.g. MED-HYCOS was started before WMO Resolution 25 became active and thus now many participating countries do not agree to publishing their data.

GRDC was advised to continue to pursue active data acquisition from HYCOS projects and also to explore the possibility to receive near real-time data from regional HYCOS data centres. It also was suggested to discuss the issue of data transfer from HYCOS to GRDC in the AWG.

6.3 IGOS Water Cycle Theme

IGOS was launched in 1998 in order to unite the major satellite and surface-based systems for global environmental observations of the atmosphere, oceans and land in a common framework including the G3OS. (Further details are available from http://www.igospartners.org/)

The IGOS Partners accepted the IGOS Integrated Global Water Cycle Observation (IGWCO) theme to be developed. The WCRP took the lead in developing a proposal for IGWCO. An integrated water cycle observational system will bring together the capabilities of both satellite based and ground based observing systems. These observing systems would support research activities dealing with the role of the atmospheric water cycle in climate, and prediction systems. In addition, networks and systems for monitoring surface and sub-surface water cycle components such as streamflow and soil moisture are integrated to provide background information on the impacts of variability and trends in the global water cycle.

A series of three workshops has been held between January and March 2003, one in the US in early January 2003 on surface hydrology, another in Japan on precipitation in mid March 2003 and one held by ESA in the period March 5-7 at ESTEC, Noordwijk, The Netherlands, which centred on applications related to the water cycle, such as extreme events, water availability, water quality, resource management – such as hydropower, planning and land use –, permafrost/climate, NWP and climate modelling, etc. The purpose of the workshops was to define priorities, specific ideas and approaches for incorporation in the final report. GRDC attended and contributed to the second workshop in the Netherlands, stressing the aspect of developing hand-in-hand with new observing capabilities a thorough metadata structure to ensure the access to the ever growing amounts of data.

6.4 GCOS, GTN-H, 2AR

The Global Climate Observing System (GCOS) together with WMO is a co-sponsor of the Global Terrestrial Network for Hydrology (GTN-H, http://gtn-h.unh.edu). The goal is to

present world-wide near-real-time (NRT) data of 10 hydrological variables. GRDC participates in GTN-H aiming at contributing the discharge component.

The project has been recognised during the Eleventh Session of the WMO Commission for Hydrology (CHy) in Abuja from 6-16 November 2000 (see items 19.1.17-19 of the CHy report).

Several meetings have taken place to develop an implementation strategy and define products:

- Establishment of a Hydrological Network for Climate, Geisenheim, 26-30 June 2000. Report available at http://www.wmo.ch/web/homs/documents/english/geisenheim.pdf;
- Expert Meeting on the Implementation of a Global Terrestrial Network-Hydrology (GTN-H), Koblenz, 21-22 June 2001. Report available at http://www.wmo.ch/web/gcos/Publications/gcos-71.pdf;
- From 18-20 November 2002 a subsequent WMO Expert Meeting on "Hydrological Data for Global Studies" was held in Toronto, Canada, followed by a meeting of the GTN-H coordination panel from 21-22 November again in Toronto (reports available at http://www.wmo.ch/web/gcos/Publications/gcos-83.pdf and http://www.wmo.ch/web/gcos/Publications/gcos-84.pdf).

At these meetings it was recognized that there is a critical need for improved availability and access to global hydrological data, information and products for climate and hydrological research and applications in order to quantify key environmental change processes, identify significant trends, assess variability and develop response strategies. The GTN-H will consist of existing networks, global databases and global data product centres, capturing ten key hydrological variables. The following are the main objectives for the network:

- Respond to urgent information requirements with regard to climate prediction, impacts and adaptation, including the characterisation of hydrological variability to detect climate change;
- Assess water sustainability as a function of water use versus water availability;
- Improve understanding of hydrological processes.

One of GRDC's contributions to GTN-H will be the creation of an internet based Near Real Time (NRT) Monitor tool for discharge data (GRDC NRT-Monitor) used among others for the Global Terrestrial Network for River Discharge (GTN-R, http://gtn-r.bafg.de). The core of the project will be a software to collect NRT-discharge data from distributed sites in the internet and make it available in a harmonised way via the internet and a software to display the collected and harmonised NRT-discharge data graphically in a web page by means of an internet map server similar to the USGS WaterWatch (http://water.usgs.gov/waterwatch), that displays the occurrence probability of the currently measured NRT-discharge values based on the long term characteristics.

It is expected that the benefit of such a system – provision of easier, unified access to information on NRT discharge data – will serve as a stimulating good example for the international exchange of hydrological data by providing a visible platform.

Previous achievements that GRDC will apply in this project are a prototype of a NRT-Monitor that has already been developed by GRDC in the framework of the European Flood Forecasting System (EFFS, see also section 7.2) and an Internet Map Server (IMS), already

available at the BfG and which will be made available to implement the planned mapping facility.

SC noted these developments with appreciation and encouraged GRDC to continue pursuing the important goals of GTN-H. Mr Grabs informed the SC about plans of the United States to make available funds for G3OS including hydrology and stressed the importance of a project proposal that defines priority stations prior to establishing contact with NHS.

SC was informed about the publication of the Second Report on the Adequacy of the Global Climate Observing Systems (2AR). GRDC was contributing author and is pleased to see the issues of "Effective Data Exchange and Access", "Standards" and "Planning and Reporting" being highlighted at prominent position, i.e. in Conclusion 2 and 3 and 12 to 15 of the Executive Summary. Based on the 2AR GCOS plans to develop an implementation plan. GRDC is confident that such a plan, given its high visibility in the context of the UNFCCC, in the mid-term will be helpful in improving the data providers responsiveness to data requests by GRDC.

Mr Wellens-Mensah recommended to follow up contacts of a GCOS regional meeting from 27-29 March 2003 in Niamey, Niger, which – among other issues – dealt with the rehabilitation of the AOC-HYCOS network. Mr Grabs informed the SC about the GCOS strategy of convening regional meetings in order to improve local knowledge with regard to the upcoming GCOS implementation plan (see also http://www.wmo.int/web/gcos/GCOS_RWP.htm).

6.5 UNESCO/IHP, FRIEND, HELP

IHP, being the follow-up of the International Hydrological Decade (IHD) that lasted from 1965-1974, is defined in phases. Currently we are in phase VI from 2002-2007. These are the major themes:

Theme 1:	Global Changes and Water Resources
Theme 2:	Integrated Watershed and Aquifer Dynamics
Theme 3:	Land Habitat Hydrology
Theme 4:	Water and Society
Theme 5:	Water Education and Training

FRIEND (http://www.nwl.ac.uk/ih/www/research/bfriend.html) and HELP (http://www.unesco.org/water/ihp/help) are regarded as essential cross-cutting components of phase VI of the IHP.

Mr Gwyn Rees, CEH, provided the SC with a summary report on the UNESCO/IHP Programme "Flow Regimes from International Experimental and Network Data Sets" (FRIEND, http://www.nwl.ac.uk/ih/www/research/bfriend.html), an activity that was started by 4 researchers in 1985 (see PPT-file in the digital annex, agenda item 6.5.1).

Since 1993, co-operative activities with GRDC have been envisaged and carried out. These activities include participation of FRIEND representatives in GRDC-SC meetings and vice-versa.

GRDC is acting as Regional Data Centre of the North European component of the UNESCO/IHP Programme "Flow Regimes from International Experimental and Network

Data Sets" (NE-FRIEND). It is responsible for the data acquisition for five central European countries, i.e. Germany, Austria, Switzerland, Czech Republic and Slovakia.

SC was furthermore informed about two envisaged activities, namely:

- FRIEND-GRDC collaboration in data acquisition and metadata compilation;
- Transfer of the management of the European Water Archive from CEH to GRDC.

A summary of these activities is available from section 6.5.1 of the annotated agenda in Annex 2.

Mr Liebscher brought up the issue of transferring data provided for FRIEND also to GRDC, however, Mr Grabs explained that this is not possible due to incompatible data policies of both organisations. Mr Demuth remarked that researchers trigger the FRIEND data acquisition, together with CEH and 4 regional data centres. Mr Fraser pointed out, that acquisition requires resources and this is a concern at GRDC.

Mr Gwyn Rees, CEH, also provided the SC with a summary report on behalf of Ms Camille Talayssat, UNESCO, on the status of the joint UNESCO/WMO Programme "Hydrology for the Environment, Life and Policy" (HELP, http://www.unesco.org/water/ihp/help), see also the PPT-file in the digital annex, agenda item 6.5.2.

HELP is designed to establish a global network of catchments to improve the links between hydrology and the needs of society. As a cross-cutting programme of the UNESCO International Hydrological Programme, HELP is expected to contribute to the World Water Assessment Programme (WWAP), and the Hydrology and Water Resources Programme of WMO. Currently, 20-22 basins have been selected.

Mr Grabs informed the SC that in July 2003 a liaison meeting between UNESCO/IHP and WMO/HWRD is being scheduled. Mr Demuth added that the German project GLOWA Obervolta will possibly become a HELP contribution.

6.6 WWAP/WWDR

Mr Jimbow gave a presentation on the status and future planning of the World Water Assessment Programme (WWAP, http://www.unesco.org/water/wwap/), see also the PPT-file in the digital annex, agenda item 6.6.

The WWAP has been established as a joint effort composed of 23 partners of UN systems (Programmes, Agencies, Regional commissions, Conventions and Decades). The Secretariat was opened in spring 2000 and is located at UNESCO headquarter in Paris. Financial foundation is provided by national governments (major share by Japan), institutions, NGO, etc.

The WWAP has four major activities, namely

- the biennial World Water Development Report (WWDR);
- an Information Network;
- a Capacity Building component;
- applications, mainly in the area of water conflict resolution.

The 1st WWDR was produced under serious time pressure, thus – besides developing a network – pragmatically concentrated on goals that promised to be achievable within the limited time span of around two years. Activities, aimed at building long lasting fundaments such as a sound and comprehensive database, where not lost out of sight but maybe for the time being ranked lower in the first period. After release of the first edition of the WWDR at the occasion of the WWF3 in Kyoto, Japan, in March 2003 this seems to have changed now.

According to recent communications with Gordon Young and Bhanu Neupane more emphasis is planned to be put on what is called the WWAP data system. WWAP wants GRDC to be part of it early on for the second phase.

WWAP requested GRDC to present on "Intergovernmental arrangements and problems of data sharing" at the Monitoring Tailor Made Workshop in The Netherlands in September 2003 (http://www.mtm-conference.nl) an event that is been sponsored among others by WWAP (presentation available at http://grdc.bafg.de/?3997).

SC was informed that after a budget of around 6 Mio US$ was spent in first phase of WWAP, for the period June 2003 - Dec 2006 around 5.5. Mio US$ will likely be made available for phase 2 (~3 Mio US$ from Japan, ~1.5. Mio US$ from Italy and around ~0.7 Mio US$ from UK, along with smaller contributions from Germany, The Netherlands, Hungary). It is envisaged to have 30 case studies in the second phase.

SC war informed about the work of the Advisory Group for the WWAP Information Network which first met in October 2001. A report on the conceptual framework was handed over to GRDC. With respect to the challenge "Ensuring the knowledge base" an information network to support indicators development shall be developed. However, currently this is difficult, as indicator methodologies are not yet fully developed and discussions with WWAP UN-Partners are ongoing. Also the work of UN-GIWG (Geographical Information WG) needs to be taken into account. In addition non-UN organisations may also contribute, such as GIWA, UN-ECE, OECD. With respect to the earlier recommendation of the SC to GRDC to liaise with WWAP in relevant aspects of information management, Mr Jimbow noted that currently no specific meetings related to this topic are planned.

Mr Ryabinin requested information about the nature of the indicators. Mr Grabs elaborated on the problem that it is very difficult to come up with a comprehensive set of universally valid indicators, and he stressed that there will be indicators, that are meaningful in one region but not in the other. The Human Dimensions Report lists more then 200 indicators. In view of the comprehensive amount of data required to determine as many indicators Mr Fraser, refering to the problem of an information network, expressed the view to rather build on existing systems then start from scratch.

6.7 UNEP

Mr Fraser provided the SC with information on developments at the Division of Early Warning and Assessment (DEWA) of the United Nations Environment Programme (UNEP).

During the 22nd Session of the UNEP Governing Council (GC 22) in Nairobi, Kenya, 3-7 February 2003, it was re-enforced that DEWA is a scientifically based unit. Dr Steve Lonergan, a Canadian with a background in biology became the new director of DEWA beginning from 1 July 2003. He has been working for improved funding of DEWA in order to increase visibility and the impact that DEWA programmes should have. The scientific basis/

aspect should be increased and products be developed supporting water policy strategy and water quality and quantity issues within the framework of the Global Programme of Action for Protection of the Marine Environment from Land-based Activities (GPA, http://www.gpa.unep.org). A new action to better coordinate groundwater research has been launched as 2 billion people depend on ground water. He gave the example of the State of Arizona withdrawing twice as much groundwater then is recharged; 12 Megacities with populations of >10 Million people each heavily depend on groundwater. IPCC demands to develop strategies for adapting to change. In the Stockholm Convention on Persistent Organic Pollutants (POPs) it has been stipulated to report in depth about POPs by 2009. This sets the framework in which DEWA was re-thinking the role of the GEMS/Water Programme.

6.8 Global data centres

6.8.1 GWPO (GEMS/Water Programme Office)

Mr Fraser gave a presentation on the status of the GEMS/Water Programme Office (GWPO, http://www.gemswater.org), formerly known as GEMS/Water Collaboration Centre (GWCC), see also the PPT-file in the digital annex, agenda item 6.8.1.

Mr Fraser explained that Canada, in the context of the WSSD in Johannesburg 2002, committed to spend 5 Million CAN$ for the improvement of the GEMS/Water Programme. The money is planed to be put into a trust fund at UNEP. The former GEMS/Water Collaboration Centre (GWCC) will be upgraded to the GEMS/Water Programme Office (GWPO) and will have exclusive access to the trust fund. This puts GWPO in the position to increase its staff (8 full time staff plus 2 students) and increase its activity. DEWA asks GWPO to continue to move from mere raw data collection to data product development, encompassing activities such as water quality analysis, inter-laboratory studies on QA/QC, increased feedback to data providers and a participation of GWPO in WWAP/WWDR.

Mr Fraser stressed the good connections to GRDC which he regards as a sister organisation. GRDC and GWPO are mutually promoting their respective data sampling missions. Joint programs have been envisaged and undertaken following an earlier working agreement between GWPO in Burlington and the GRDC. Collaborative activities relate to an update of the joint metadata catalogue for users produced in late 1998, describing measuring stations at rivers which are common in both databases (or close, as stations tend to be maintained by different authorities). Using GEMS and GRDC data, further steps envisaged are the calculation of suspended sediment load of selected rivers to the world oceans, basin assessments of water quantity and quality, and data acquisition depending on the availability of resources of GEMS and GRDC.

6.8.2 GPCC (Global Precipitation Climatology Centre)

Mr Rudolf gave a presentation on the status and activities of the Global Precipitation Climatology Centre (GPCC, http://www.dwd.de/research/gpcc/) located at the German Weather Service DWD (http://www.dwd.de), see also the PPT-file in the digital annex, agenda item 6.8.2. The SC was among others informed about the experiences in data acquisition, the QA/QC procedures applied to new data arriving at GPCC and ongoing

research projects using the GPCC data (currently around 42000 stations from 173 countries). Major projects include:

- Establishment of a new correction method for systematic gauge measuring error (with Univ. of Vienna);
- Verification of precipitation results from satellite observations and numerical re-analyses ERA-40 and NCEP (with Univ. of Vienna);
- Collection of historical data and statistical analysis of long time-series (with Univ. of Frankfurt) in order to overcome GPCC's limitation so far, i.e. focusing on the GEWEX period 1986-2000;
- Development of an Arctic precipitation climatology (with ACSYS and Univ. of Bonn).
- Development of an advanced multisensor precipitation estimator for MSG (with EUMETSAT);
- Analysis of precipitation patterns for flood events;
- Water budget studies (with GRDC and other institutes, ELDAS).

Further background information is provided in section 6.8.2 of the annotated agenda in Annex 2.

Concerning the earlier recommendation of the SC to cross-validate GPCC and GRDC data, Mr Rudolf mentioned GPCC plans to allocate money to pay a student for an external study on the estimation of runoff coefficients. However, current problems include differences in time series length, but certainly this kind of work will be an option for the future.

6.8.3 IGRAC (International Groundwater Assessment Centre)

Mr van der Gun gave a presentation on the status and further planning of the International Groundwater Assessment Centre (IGRAC, http://www.igrac.nl), see also the PPT-file in the digital annex, agenda item 6.8.3.

The 14th Intergovernmental UNESCO-IHP Council (June 2000) adopted Resolution XIV-11 and the 11th Session of the WMO Commission for Hydrology (November 2000) adopted Recommendation 1 (CHy-XI), both with regard to the establishment of an International Groundwater Resources Assessment Centre. The Netherlands Institute of Applied Geoscience TNO has been proposed to establish and accommodate IGRAC. Funding has been provided by the Dutch Government for 2003-2004 and IGRAC was inaugurated at the WWF3.

Mr van der Gun pointed out that because of the intrinsic difference between surface water data (integrating over an entire catchment area) and groundwater data (point data with very limited areal representativity), IGRAC will follow an approach different from GRDC's approach and start by focusing on macroscopic indicators rather than on field data, in combination with metadatabases and with activities to promote adequate groundwater data acquisition.

SC was informed about the planned development of groundwater GIS guidelines. IGRAC can not function properly without world-wide inputs and support. Mr Hubert pointed to the problem of languages when trying to integrate local groundwater relevant documents from all over the world. Mr Maurer stressed the need for a good metadata inventory to enable the

maintenance of large amounts of data. Mr Ryabinin inquired about the planned strategy for data access. Mr Grabs explained that IGRAC has been endorsed by EC and access to data will be free and open.

7 Other Collaborations

7.1 Research groups working with GRDC data

Due to limited staff capacity GRDC has established the practice to outsource additional research activity, undertaken in collaboration with partner and research institutions interested in working with larger amounts of GRDC data. The following cooperations are finalised, ongoing or under negotiation, respectively:

Finalised:

- Center for Environmental Systems Research, University of Kassel, Germany: Global Water Assessment and Prognosis model WaterGAP;
- University of New Hampshire, USA: Global Composite Gridded Runoff Fields.

Ongoing:

- Oregon State University, USA: Study and examination of the influences of hydrologic variability and extremes on water related political conflicts and cooperation in international river basins;
- University of Tokyo, Japan, Institute of Industrial Science: Estimating hydrological extremes of the 20th century in major river basins: Inter decadal and inter annual variation of seasonal flood and drought;
- University of Tokyo, Japan, Institute of Industrial Science: Streamflow validation among GSWP-2 participating LSMs during 1986-1995: a part of the validation activity of GSWP-2;
- Polish Academy of Science, Poznan, Polen: Trend analysis of long global discharge time series';
- Technical University of Dresden, Lohrmann-Observatory, Germany: Development of a physically consistent system model for the examination of rotation, morphology and gravitation field of the earth;
- University of Bonn, Meteorological Institute, Germany: Examination of extreme precipitation and flood events in Europe during the past 100 years;
- University of Washington, USA: Study and examination of the Adjustment of Gridded Precipitation for Orographic Effects.

Under negotioation:

- Federal Institute for Geosciences and Natural Resources (BGR), Hannover, Germany: Verification, extension and attributation by discharge data of a map representation of the major global streams in the context of the generation of a hydrogeological map of the

world within the scope of the World Hydrogeological Mapping and Assessment Programme (WHYMAP);

- University of Greifswald, Germany: Improved models for time series components by identification of large scale patterns in seasonal and long term components of global discharge time series';

Further background information is provided in section 7.1 of the annotated agenda in Annex 2.

SC welcomed the initiative of GRDC to establish collaboration contracts and to request to publish research based on considerable amounts of GRDC data in the GRDC Report Series as it demonstrates GRDC data applications. This is helpful in many respects, including:

- triggering increased awareness and acceptance of data providers;
- connecting people and documenting research on global river discharge;
- demonstrating use and need to GRDC's funding German ministry BMVBW.

SC encouraged GRDC to extend this type of collaborative activity.

7.2 European Flood Forecasting System (EFFS)

Mr Maurer gave a brief overview on GRDCs contribution to the European Flood Forecasting System (EFFS) which was a project under the fifth Framework Programme of the European Commission, see also the PPT-file in the digital annex, agenda item 7.2.

The EFFS project aims at developing a prototype of an European flood forecasting system for 4-10 days in advance that takes advantage of currently available Medium-Range Weather Forecasts e.g. from the European Centre for Medium-Range Weather Forecasts (ECMWF http://www.ecmwf.int/). This system will provide daily information on potential floods. This activity is currently extended in the LISFLOOD ALERT project at the EC Joint Research Centre (JRC), Ispra, Italy.

The task of the GRDC was to provide the project with Near Real Time runoff data for the example catchment of the Rhine river. In the framework of the project GRDC developed a prototype of a data integrating platform that will also be the basis for further endeavours of the GRDC with respect to the GTN-H.

7.3 GLOBWINET – co-operation in an Associated Programme (AP) of the Global Water Partnership (GWP)

Mr Winnegge gave a brief overview of the GLOBWINET Project (http://www.globwinet.org/), see also the PPT-file in the digital annex, agenda item 7.3. It is one of the Associated Programmes of the Global Water Partnership (GWP, http://www.gwpforum.org) in the context of Integrated Water Resources Management (IWRM). GLOBWINET is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ, http://www.bmz.de/en/index.html) and implemented by the German Agency for Technical Cooperation (GTZ, http://www.gtz.de/english/). In this project GRDC is a subcontractor of

GTZ, responsible for triggering the provision of quality information on the German water resources sector for GLOBWINET.

GLOBWINET aims at providing an information platform for integrated water resources management. Basically, it is an internet-accessible database of water-administration related information around the globe which can be fed and administrated in a decentralised fashion. It links the names of individuals, organisations and text materials. At present, the South African component SAWINET and the German component GEWINET are under development.

GRDC has been charged with building a "Water Resources Management Country Profile Germany", i.e. a concise compilation that provides easy access as a whole to various scattered and fragmented sources already reporting on different aspects of the German water management sector (GRDC Report 27). The core chapters of the report deal with "Geography and Hydrology", "Structures and Co-operation in Water Resources Management", "Legal Framework for Water Planning and Management" and "Usage of Water" in Germany. The electronic version of the report (available at http://grdc.bafg.de/?911) allows to directly link to the web-pages of most of the cited sources.

GRDC will present GLOBWINET at the Sixth Water Information Summit (http://www.irc.nl/page/13858) that will be held in The Netherlands in September 2003, an event that is been sponsored among others by WWAP.

More recently GRDC's focus within GLOBWINET shifted again towards SAWINET in the South African region. The project will likely be closed end 2003.

SC noted with appreciation the progress made in this project. It provided GRDC with the opportunity to enlarge its experience in the field of documentation and metadata management.

7.4 IFNet (International Flood Network)

The International Flood Network (IFNet, http://www.internationalfloodnetwork.org) was officially launched during the WWF3 in Kyoto in March 2003. It has as its objective to facilitate international cooperation in flood management in order to reduce the loss of life and damage caused by floods and to promote policies and practices which can break the vicious circle of poverty and environmental degradation and lead to a safe and sustainable future

Guiding idea of IFNet is the need for a shift of emphasis from reactive to proactive action. Though flooding is often a very local problem that can benefit from national and international assistance. IFNet aims at facilitating the identification and solution of problems, without imposing on the rights of the local and national authorities concerned.

Planned activities of IFNet include:

- Exchange of information, experience, technical knowledge and future plans with the aim of enhancing concrete co-operative action.
- Raising public awareness of floods by compiling and disseminating information and views on such aspects as health, culture, education, gender etc.
- Establishing floods high on the international agenda, and producing periodic newsletters and reports on flood-related activities and commitments.

SC noted this new initiative on flood management, driven by the Japanese MLIT. Mr Grabs informed the SC about the IFNet's vision of developing a 3h-lead-time basin flood early alert system called a Global Flood Alert System (GFAS) possibly incorporating information delivered by the TRMM satellites (http://trmm.gsfc.nasa.gov).

8 Metadatabases

Mr Maurer gave a brief overview on the topic of metadata, which has been on the agenda since several years (see summary provided in section 8 of the annotated agenda in Annex 2 and the PPT-file in the digital annex, agenda item 8) and attracts growing attention by the international research and assessment community in all fields of geophysics, thus reflecting the urgent need to arrive at improved ordering schemes and decreasing access times for a given information.

Mr Maurer stressed that integration efforts for geographic data and information are already much advanced, i.e. by the development of the metadata standard ISO 19115 of ISO/ TC 211 on Geographic Information/ Geomatics. Since 8 May 2003 this standard is in stage 60.60, i.e. approved as "International Standard Published". Many organisations are now developing new or are migrating their existing metadatabases on geographical information to ISO 19115 conformity. The developments achieved in this field may serve as a template for a more general approach for information integration of observations of geophysical processes of any kind, including river discharge. Further background on ISO 19115 is provided in section 8 of the annotated agenda in Annex 20 as well as on the GRDC web site at http://grdc.bafg.de/?2376 and related pages.

Mr Fraser regarded it as vital to keep in mind that there are different methods available and mentioned the Dublin core which seems to be another upcoming standard.

Mr Grabs stressed that the problem of advancing the metadata issue is of real urgency. However, to date acceptance of a single standard is still a problem. There are two different types of metadata, i.e. those used for the description of data on state variables and fluxes as well as library-like metadata information related to written material (books, reports, journals, documentation), persons, organisations and projects, as e.g. managed by a system as GLOBWINET. Mr Maurer was of the opinion that these two types of metadata need to be connected, i.e. often written material is based on data and these two entities need to be traceable as a unit. ISO 19115 allows for this.

Mr Grabs stressed that in the field of hydrology the GTN-H platform provides a prime chance of advancing the metadata issue. He encouraged GRDC to consider the outcome of the relevant WMO expert meetings (especially CBS) and suggested to investigate the approach GEWEX and CEOP have taken in managing merged satellite based and terrestrially measured data. SC supports the proposed path of GRDC in developing data management strategies applying ISO 19115.

Mr Ryabinin informed the SC about data exchange in the Oceanographers community which applies XML and current considerations to apply ISO standards for meteorology. Looking at the history of metadata management strategies applied, convergence is evident. He recommended GRDC to participate in the process in the best possible way. It is important to ensure interoperability by open systems connections. It may be necessary to wait for a little while until current developments have settled. Mr Maurer pointed out that XML by itself does

not define a metadata standard but only is the (standardised) currently most appropriate technology to apply as a vehicle for the implementation of a metadata standard.

Mr Grabs suggested that GRDC should volunteer to establish a working group and serve as a catalyst in developing metadata management strategies, possibly in cooperation with e.g. groups like the CliC DMIP (Data Management and Information Panel, http://ipo.npolar.no/org/dmip.php) and the GHP DMWG (Data Management Working Group, http://www.joss.ucar.edu/ghp). It is necessary to build up ownership in the topic and search the acceptance of methodologies by such groups. At the moment within WWAP the status of development of data management knowledge is at a rudimentary level, however, it is planned to develop an information base.

In view of capabilities and capacities of less developed countries, Mr Wellens-Mensah recommended that while harmonising metadata is important for the evaluation of information, it were advisable to keep approaches simple enough. It has to be kept in mind that the industrialised countries are not alone! Mr Maurer, though understanding this point of view, opposed in a sense that without a certain level of technology, data integration will not be successful. It will be necessary to ensure automation which is equivalent with "machine readability ".

Mr Jimbow supported the idea of GRDC to start an initiative and suggested to prepare proposals to donors (governments), thereby building on existing standards. However, he also saw the problem of inadequate acceptance or understanding of potential donors.

Mr Rees supported this by stressing not to be too ambitious, but rather realistically build on existing schemes. It is necessary to be practical as there are different types and levels of metadata management. The cooperation of data providers is required and their willingness and ability to make investments has to be kept in mind, leave alone the costs involved with regular providing.

Mr Grabs realised a slight misunderstanding and stressed that standards can only provide a framework, they are like a home, but rooms have to be populated. There are rules, what to use the rooms for, however it has to be decided, what is essential. One should follow the standard but not necessarily one for all kind of variables.

Mr Maurer replied that this is just the critical point: the current situation is, that we already have all these pragmatic approaches as people all over the world and disciplines realise that they have to do something about the disorder. Consequently, metadata information systems are mushrooming everywhere (though not necessarily such called!) but on a global scale or from an interdisciplinary point of view there still remains disorder, even though on a slightly higher organised level. What is required is the propagation of the development of a solution with a long term perspective, necessarily involving politics and in the end the public. It is due time to start it, ideally pushed forward by international organisations, which particularly had to resolve problems related to the discrepancy of knowledge at the technical level as compared to understanding at the political level.

Mr Grabs replied that there is a saturation of new ideas which asymptotically will converge towards a solution. He suggested to plead the GTN-H expert group including GRDC, being endorsed by a mandate of UN-organisations, for further developing a strategy.

Mr Rees suggested to put a proposal together and discuss it in the GTN-H panel. Mr Grabs reaffirmed this suggestion by requesting GRDC to initialise the process by writing a GRDC report on the problem and to develop a concept for a prototype metadata infrastructure.

Mr Maurer responded that GTN-H yet has no own resources and that it will be difficult to demonstrate usefulness of a complex approach if not a "critical mass" is participating. For this reason he regarded it as important to involve already at an early stage a major player such as an international organisation with a stronger outreach helping to propagate standardisation. In this context Mr Ryabinin mentioned the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) which already a long time ago had established the International Oceanographic Data and Information Exchange (IODE). It might be studied as a model.

Mr Wilke concluded that eventually a greater effort will be needed, to pave the road for a wider distribution and acceptance of metadata systems and standards. This will inevitably require to involve politics and – associated with this – funding issues. However it might be too early for this.

Summarising, SC recommended to take the following steps: GRDC should write up a report on the metadata issue, develop a concept, discuss this in the GTN-H panel and in expert groups. Based on this, within a pilot study a prototype should be developed, that demonstrates the advantages and capabilities.

9 Review of GRDC collection criteria for discharge stations

Mr Maurer gave a brief overview on the topic, see also the PDF-file in the digital annex, agenda item 9.

In the 14 years of existence of the GRDC the collection criteria have widened due to the requirements of different clients. A strict categorisation of discharge stations remains difficult without exact knowledge of the local characteristics. E.g. at Environment Canada it took a large project to classify Canadian stations involving the hands-on experience of locally based employees, handling the equipment on a day-to-day basis.

5th SC recommended that GRDC develop an information note on the collection criteria for GRDC stations. In Annex 11 of the Report of the 5th SC thus a draft, entitled "Information note on GRDC station selection criteria, data format and data transfer", was presented. It is subdivide in 5 sections, namely:

1. Which information the GRDC is interested in?
2. Metadata
3. Guiding criteria
4. Method of data transfer
5. GRDC's preferred data file format

SC was requested and invited to discuss the draft information note in subsequent meetings.

There was little discussion on the selection criteria, SC regarded them as acceptable. Mr Ryabinin confirmed, that especially stations nearest to the mouth have high priority.

10 Review of GRDC data policy and data acquisition strategy

Mr Maurer gave a brief overview on the topic, see also the associated PDF-file in the digital annex, agenda item 10.

The current data policy, namely:

- Free and unrestricted (but identified) access to all hydrological data and products;
- Data are free of charge (only costs of services and reproduction);
- No commercial use, commercial use may be subject to conditions;
- Ownership of data and responsibility for errors lies at the data providers;
- No redistribution of data by the user;
- No distribution of the whole database (or substantial parts)

was briefly discussed again.

Current practice is that a potential data user has to identify himself and his purpose and to agree upon the data policy by signing a declaration (which can be sent by fax). The data policy takes into account the considerable reluctance of data providers to let their data circulate freely (in spite of WMO-Resolution 25, Cg-XIII, 1999) and is determined by an international steering committee. After identification, GRDC's basic data provision method is to disseminate the requested data non-bureaucratically as an email attachment or - if the requester does not provide an email address - by mailing CDs.

At the 5th SC the proposal was made by GRDC to flag all GRDC data to distinguish three classes of data:

- *Free access* (all that data which is already freely available anyway);
- *Free and unrestricted* (but identified) access (current practice);
- *No access to raw data* (only use for GRDC products allowed).

At 5th SC the view was expressed that the GRDC data policy cannot be more restrictive than Resolution 25. In particular the principle of free and unrestricted access to hydrological data supplied voluntarily by countries who are cognisant of Resolution 25 and the GRDC data policy would not be consistent with the idea to flag data as not being accessible. On the other hand for some parties it is difficult to understand why the access to their data that they already have published at their web-pages is aggravated again by the "identification-wattle" as a result of current GRDC policy guideline practice. Related to the earlier recommendation of the SC to GRDC to seek guidance in this critical matter from the AWG, there has not yet been a comment. SC nevertheless encouraged GRDC to start developing a procedure to provide data mix (freely available, restricted, not available). However, for the time being, SC was of the opinion to leave the data policy as it is.

Regarding the priorities of where to concentrate GRDC's up-dating capacity 5th SC suggested to emphasis up-dating of the already existing project data sets of 251 stations on rivers close to the oceans and the almost 3000 stations featuring long time series', significant basin areas or very pristine conditions. In addition, data sets such as for the ISLSCP-II initiative (see agenda item 8.1.1) or CEOP should be put high on the agenda regarding updating efforts.

Related to the earlier recommendation of the SC to GRDC and/or WMO to address the Hydrological Advisors of the Permanent Representatives of a country to WMO and by carbon copy the Permanent Representative, Mr Grabs informed the SC that 1996 was the last official mailing of the WMO SG to member states (see http://grdc.bafg.de/?6925). Some discussion developed on the usefulness of such a standard procedure. Mr Hubert and Mr Demuth stressed the advantages of project related acquisition in direct contact, for a targeted area of e.g. 5 - 10 stations per country, according to specific criteria. Mr Fraser reported of GEMS/Water's good experiences with introducing value added components, i.e. activity of benefit for the potential data donors, such as studies, consulting or software tools. SC affirmed this view and Mr Grabs recommended to seek ways to feedback to data providers and establish closer contact, e.g. by means of GTN-H. Mr Demuth added that FIGCC, the FRIEND Inter-Group Coordination Committee might be potentially helpful in this. Mr Wellens-Mensah advised to make use of organisations already active in a region such as French IRD (former ORSTOM). Mr Jimbow added discharge data collected in the framework of WHO research on river blindness (Onchocerciasis Control Program, OCP).

Related to the earlier recommendation of the SC to GRDC to develop a pragmatic concept aimed at improving contacts with data providers and possibly providing certain incentives for data providers to deliver more data in a timely fashion, it was recommended to consider the development of a software suitable to plausibility check discharge data for free distribution. This was discussed further under the following agenda item 11 on QA/QC.

11 Quality assessment and quality control of GRDC data

Mr Pauler gave a brief overview on the topic, see also the files in the digital annex, agenda item 11.

Quality control (QC) and quality assurance (QA) activities have long been on the agenda of the SC. Responding to SC suggestion to define and implement a quality assurance program within the limitations defined by the availability of additional information, GRDC has already developed the so-called “Plausibility Tool”, which allows to comfortably check incoming new data against the context defined by data already in the database.

Recognising the complexity of the QA/QC issue, the 5th SC recommended that an Expert Meeting be organised on the automation of QA/QC procedures for real-time estimation of water level and discharge data. Such a meeting would fall under the joint auspices of the WMO and UNESCO. 5th SC recommended to encourage Mr Pilon to take the lead - also in his role as Chairman of the CHy Working Group on Hydrological Forecasting and Prediction - in organising such a workshop and pursue the matter further. 5th SC further recommended that GRDC should closely collaborate with this initiative and the corresponding experts of the working groups of the Commission for Hydrology, CHy.

Given the various activities of the CHy, including the WMO "Guide to hydrological practices" (WMO-No. 168) and the HOMS Programme, SC reiterated its attitude that GRDC should participate in these efforts. Mr. Grabs recommended that the AWG should develop an action table related to QA/QC and give the topic a high priority in the CHy. SC further recommended that GRDC documents the plausibility check procedures currently applied in the GRDC database management as a technical note. Mr Pauler informed the SC about his current activity to implement algorithms of the German gauging station regulation (Pegelvorschrift) which will improve the options for plausibility checks.

Mr Wellens-Mensah inquired about the possibility to provide these plausibility check routines as a tool for data providers as incentive. Mr Pauler responded that currently these routines are no stand-alone applications, but rather directly integrated in the database interface and requiring the GRDC database to be accessible. Mr Grabs suggested to explore the possibility of developing the GRDC plausibility check routines as a HOMS component, possibly by aid of a small financial contribution WMO to employ a student.

Mr Kinosita expressed his view, that there is no way around the necessity of data providers to check their data themselves, as they command over the inevitably required local knowledge, especially when it comes to judging the rating curves. Mr Kinosita furthermore suggested to perform plausibility checks by correlation of up- and downstream stations. Mr Maurer informed the SC about the ongoing preparations of the GRDC database for this purpose by systematically assigning downstream stations to all GRDC stations.

12 Review of the Action Table resulting from the previous SC meeting

The action table resulting from the 5th SC was reviewed (provided again in section 12 of the annotated agenda in Annex 2 and in a file in the digital annex, agenda item 12.

SC noted with appreciation that GRDC had made progress with many action items. Some will need further attention and continuation. This is also a matter of priority. The results of most discussions are included in the text of the respective sections of this report, to avoid their appearance at too many places. A few could be dropped from the agenda, including:

With respect to the earlier recommendation that WMO should write acquisition letters on evapotranspiration data to the individual members and forward the response to GRDC, SC was now of the opinion that this should not be a topic of concern and a task for GRDC, nor for GPCC, but possibly for FAO.

Related to the earlier recommendation of the SC to CHy to clarify the role of GRDC as compared to the role of WMO World Data Centres, Mr Grabs noted that there is not a sufficient legal basis as it does not exist a formal contract between WMO and BfG. Rather GRDC was initiated based on an exchange of letters between the WMO Secretary General, DWD and BfG, resulting in a memorandum of understanding.

13 Future GRDC activities - discussion of long term strategic development, work plan and priority list

Based on the results of the discussion of the various agenda items, SC was requested for guidance in prioritising future GRDC activities in the light of the limited resources of GRDC.

In the view of the fact, that present staff of GRDC resembles the equivalent of approximately 4 full-time permanent staff whose funding is provided by the government of the Federal Republic of Germany through the Federal Institute of Hydrology and on the other hand, the increasing number and extent of tasks in which an involvement of GRDC seems to be desirable, it is straightforward, that there are two principle possibilities to cope with this situation:

- Adaptation of staff and funding for GRDC to that situation;

- Concentration on priority tasks to not become a “Jack of all trades” at the cost of unsatisfying output.

SC was invited to discuss implications of the growing number of tasks and expectations on the physical development of GRDC and its work-plan priorities.

Related to the earlier recommendation of the SC to GRDC to jointly market GRDC, GEMS/Water, GPCC and IGRAC programs, SC reinforced the need to collaborate on a more institutionalised level. A good start would be joint flyer and letters. Mr Grabs reported from a recent UNESCO Bureau meeting, that during the upcoming IHP Intergovernmental Council meeting in May/June 2004 a global hydrological centre at UNH will be proposed. In this light preventive action has to be taken to ensure the continued visibility of the already existing data centres, in order to prevent marginalisation. It is necessary to rise the profile by developing and presenting products.

Related to the earlier recommendation of the SC to GRDC to plan and execute two Products Workshops, namely

- GRDC to invite around 20 representatives of the technical level of NHSs;
- GRDC to invite experts from global research and assessment community

it was suggested to plan to hold a workshop with global focus on joint GRDC-GPCC and joint GRDC-GEMS/Water products on rainfall-runoff and biogeochemical fluxes, respectively. Mr Grabs offered organisational support of WMO (nomination of experts, writing of invitations).

In view of the difficulties related to raising additional resources for GRDC, the option of outsourcing potential GRDC tasks was discussed by the SC. Mr Grabs stressed the importance of activities related to data analysis and data product generation. SC noted with appreciation the new practice of the GRDC to foster collaborations with data users (see section 7.1) that result in joint reports published in the GRDC Report Series. SC further suggested to try to attract additional temporal staff by e.g. trying to work with students and PhD candidates or seconded experts, send from their home organisations to GRDC.

Generally, GRDC's goal should be more to manage activities instead of doing research itself in order to be competitive with other emerging centres. Mr Maurer replied that this does not work for routine GRDC work and ongoing operations and Mr Liebscher remarked, that acquiring funds and temporal staff in itself also is a time-consuming process. Mr Demuth mentioned a planned meeting of the German IHP-HWRP secretariat with representatives of German universities in autumn 2003 to explore possibilities of knowledge-transfer from universities into international programmes and vice versa. He suggested this meeting could be an opportunity to initiate new collaborations.

14 Review of membership of the Steering Committee

The membership of the GRDC-SC was reviewed.

Concerning FRIEND, after retirement of Alan Gustard it was decided that the FRIEND Inter-Group Coordination Committee (FIGCC), which was established 4 years ago, will be the most suitable organisation to represent the international FRIEND community within the GRDC SC (in person of Mr Eric Servat).

Mr Jimbow requested WWAP to be listed as an observer.

Concerning the representative of a developing country, it was suggested that this representation can be regarded as covered by Mr Wellens-Mensah, in combination with his functions as CHy representative for GRDC. Furthermore, it was recommended to discuss this issue within the AWG.

Concerning the representation of the Government of Japan, it was noted that it should be formally represented through the River Bureau of the Ministry of Land, Infrastructure and Transport of Japan (MLIT) instead of the Foundation Of River & Basin Integrated Communications (FRICS).

This leads to the following future membership of the GRDC SC:

Chairman:

- Dr K. Wilke, BfG

Secretary to the SC:

- Head of GRDC http://grdc.bafg.de

Members:

- WMO http://www.wmo.int/web/homs
- UNESCO http://www.unesco.org/water
- UNEP http://www.unep.org/dewa/water
- ICSU/IAHS http://iahs.info
- BfG http://www.bafg.de
- GPCC http://gpcc.dwd.de
- GWPO http://www.gemswater.org
- IGRAC http://www.igrac.nl
- FRIEND http://ne-friend.bafg.de
- WCRP http://www.wmo.int/web/wcrp
- CHy http://www.wmo.int/web/homs/chy.html
- Government of Japan/MLIT/River Bureau http://www.mlit.go.jp/river/english
- Representatives of developing countries from WMO regions not represented at the meeting

Observers:

- WWAP http://www.unesco.org/water/wwap
- IHP-HWRP Secretariat Germany http://ihp.bafg.de
- Former Chairman, Prof. Hans-Jürgen Liebscher, serving the GRDC SC from 1988-2001

On a side note, related to an earlier request of GRDC for SC membership approval by the AWG, it was clarified that GRDC is not reporting to AWG but to the HWDP secretariat at the HWRD at WMO. The secretariat reports to the AWG. Related to the earlier recommendation of the SC to GRDC to request guidance from the AWG regarding the selection of the SC representatives of developing countries from WMO regions not represented at the meeting, it was concluded that this is pragmatically not feasible.

15 Date and venue of next meeting

SC suggested to hold the next (7^{th}) meeting of GRDC SC in summer 2005, tentatively in the beginning of July at BfG in Koblenz or at WMO Geneva. SC invited alternative suggestions by December 2003.

16 Closure of meeting

SC expressed its appreciation for GRDC's excellent work. Mr Grabs added that also the WMO Congress reviewed GRDC positively (see Annex 6) and acknowledged GRDC activities. Furthermore, SC warmly thanked GRDC for the enjoyable organisation of the meeting and BfG for hosting the meeting within its premises.

The meeting was closed on 13 June 2003 at 16:00.

Annex 1 Agenda of the meeting

6th Meeting of the GRDC Steering Committee

Koblenz, 11 -- 13 June 2003

Agenda (Status:10 June 2003)

time	*duration*		*item*	*topic*	*contributions from*
Wednesday, 11 June 2003					
9:00	0:10		**1**	**Opening of the meeting by the chairman**	Wilke
9:10	0:10		**2**	**Organisation of work and adoption of the agenda**	Wilke
9:20	0:10		**3**	**GRDC at the Federal Institute of Hydrology: review and perspectives for development**	Wetzel
9:30			**4**	**GRDC activities, status and developments**	
9:30	0:20		4.1	Homepage and public relations	Maurer
9:50	0:20		4.2	Data acquisition and database status	Dornblut
10:10	0:10		4.3	Data dissemination and use	Lüllwitz
10:20	0:15		4.4	Developments of the database management system	Pauler
10:35	0:20			*recreational break*	
10:55			4.5	Data products	
10:55	0:15		4.5.1	Mean Annual Freshwater Surface Water Fluxes into the World Oceans	de Couet
11:10	0:15		4.5.2	Long Term Mean Monthly Discharges and Annual Characteristics of Selected GRDC Stations	Maurer
11:25	0:05		4.6	GRDC reports and publications	Maurer
11:30	0:30		**5**	**WMO and CHy WG activities relevant to the work of the GRDC**	Grabs
12:00	1:30			*lunch break*	
13:30			**6**	**Status of and opportunities for GRDC co-operations in UN-Projects and Programmes**	
13:30			6.1	World Climate Research Program (WCRP)	
13:30	0:15		6.1.1	GEWEX: GHP, CEOP-I, ISLSCP-II	Maurer
13:45	0:10		6.1.2	ACSYS/CLIC	Maurer
13:55	0:10		6.2	WHYCOS	Maurer
14:05	0:10		6.3	IGOS Water Cycle Theme	Maurer
14:15			6.4	GCOS	
14:15	0:20		6.4.1	GTN-H (Global Terrestrial Network for Hydrology)	Maurer/Grabs
14:35	0:10		6.4.2	2nd Report on the Adequacy of the Global Climate Observing Systems	Maurer
14:45	0:20			*recreational break*	
15:05			6.5	UNESCO/IHP	
15:05	0:25		6.5.1	FRIEND	Rees
15:30	0:10		6.5.2	HELP	Rees/ Talayssat
15:40	0:25		6.6	WWAP/WWDR	Jimbow
16:05	0:10		6.7	UNEP	Fraser
16:15				*meeting adjourns*	
17:00	5:00			excursion + common dinner	
22:00				*approx. back in Koblenz*	

Thursday, 12 June 2003					
9:00			6.8	Global Data Centres	
9:00	0:40		6.8.1	GEMS/Water Programme Office	Fraser
9:40	0:40		6.8.2	GPCC (Global Precipitation Climatology Centre)	Rudolf
10:20	0:20			*recreational break*	
10:40	0:40		6.8.3	IGRAC (International Groundwater Assessment Centre)	van der Gun
11:20			**7**	**Other collaborations and projects**	
11:20	0:20		7.1	Research groups working with GRDC data	Maurer
11:40	0:20		7.2	European Flood Forecasting System (EFFS)	Maurer
12:00	0:20		7.3	GLOBWINET – co-operation in an Associated Programme (AP) of the Global Water Partnership (GWP)	Winnegge
12:20	0:10		7.4	IFNet (International Flood Network)	
12:30	1:30			*lunch break*	
14:00	1:30		**8**	**Metadatabases**	Maurer
15:30	0:20			*recreational break*	
15:50	0:30		**9**	**Review of GRDC collection criteria for discharge stations**	Maurer
16:20	0:50		**10**	**Review of GRDC data policy and acquisition strategy**	Maurer
17:10	0:50		**11**	**Quality assessment and quality control of GRDC data**	Maurer
18:00				*meeting adjourns*	
Friday, 13 June 2003					
9:00	1:30		**12**	**Review of the Action Table resulting from the previous SC meeting**	Maurer
10:30	0:20			*recreational break*	
10:50	1:30		**13**	**Future GRDC activities - discussion of long-term strategic development, work plan and priority list**	Maurer
12:20	0:20		**14**	**Review of membership of the Steering Committee**	Wilke
12:40	0:10		**15**	**Date and venue of next meeting**	Wilke
12:50	0:10		**16**	**Closure of meeting**	Wilke
13:00				*end of meeting*	

Annex 2 Annotations to the provisional agenda of the meeting

6th Meeting of the GRDC Steering Committee

Koblenz, 11 – 13 June 2003

Annotated Agenda

Status 10 June 2003

1 Opening of the meeting by the chairman

Mr Wilke will formally open the SC meeting.

2 Organisation of work and adoption of the agenda

The agenda will be reviewed and opportunity will be given for adjustments to the agenda.

3 GRDC at the Federal Institute of Hydrology: review and perspectives for development

The Director of the Federal Institute of Hydrology, Mr Wetzel, will present a review of the inputs provided by BfG (http://www.bafg.de) for GRDC for which the Federal Ministry for Transport and Housing (http://www.bmv.de) provides the core funding. Funding includes staff salaries, provision of office space and office infrastructure as well as data processing facilities and support of travel of GRDC staff.

After there has been a significant increase of funding during the years 1994 to 1998 the support of the GRDC has been more or less constant during the recent years. This has to be seen as a success as annual budgets of public services have been reduced in recent years.

4 GRDC activities, status and developments

4.1 Homepage and public relations

Homepage: During 2002 GRDC worked on the structure and information content of its new homepage. Since the beginning of 2003 BfG provides a content management system (CMS) WebGenesis for BfG's intranet, which in addition is sheduled to serve as the platform for BfGs home page from autum 2003. The CMS supports to delegate different aspects of a content to different groups, most notably it separates the tasks of structuring and producing of contents from the layout. The latter will be cared by a professional consultant in web-publishing, currently developing a new communication concept for BfG. The GRDC homepage is now reachable via http://grdc.bafg.de making http://www.bafg.de/grdc.htm superfluous.

The top-level structure of the homepage currently looks as follows (only main level and parts of the subsequent level are displayed):

What's New
Quick Access...
... to a brief Overview of GRDC
... for Providers
... for Potential Collaborators
... for Users
... to Specialised Databases
... to Information Networks + (Meta) Data Bases
. .. to Workshops, Conferences & Meetings (Water & Information related)
Rational & Background Information
Vision and Main Objectives
Framework
Standard Services
History
Funding
Steering Committee
Availability and Access to River Discharge Data
Decisions and Comments relevant to GRDC
Metadatabases that cite GRDC
Collaborations, Cooperations & Participations
GRDC cooperations in UN-Programmes and Projects
Other Collaborations, Projects & Participations
Partner Data Centres
National Hydrological Services
Data, Products & Reports
How to Order GRDC Data
GRDC Data Acquisition
GRDC Database Status
GRDC Database Usage
GRDC Data Products
GRDC Reports
Specialised Databases
Downloads
How to get to GRDC...
Station Catalogues
GRDC Station Selection Criteria
GRDC Data Policy
GRDC Data Products
GRDC Report Series
GRDC Flyers
GRDC User Declaration
GRDC Posters
WMO Resolutions
...other
Links
Categorised Water & Information Related Links
Alphabetic Index & Glossary
Contact & Directions
GRDC Team Picture
GRDC Forum
How to get to GRDC...
Frequently Asked Questions
Sitemaps
GRDC Calendar

Within this structure currently around 660 (atomised) entries have been generated. Large efforts have been undertaken to create a comprehensive "Alphabetic Index & Glossary" (currently around 250 entries) basically explaining acronyms of GRDC related organisations, programmes and projects as

well as their relation among each other. Here is also the only location within the GRDC web-page where the explicit link to the respective entity is provided. Within the web page an entity is always referred to via this index, thus minimising the maintenance efforts for keeping the links up-to-date.

While it has been the aim to structure the web page itself in a possible most systematic way, "Quick access" is meant to guide a potential user directly to the sub pages relevant for his specific user profile. The CMS features are ideally suited to support this goal, as they support cross-referencing in a very user-friendly way.

Poster
Two new GRDC Posters were compiled

Flyer
A new GRDC flyer has been compiled and printed

Presentations
The GRDC has been presenting its work and services at various occasions, most notably at the the WWF3 in Kyoto in March 2003 and at the International Freshwater Conference in Bonn in December 2001.

A list of GRDC participation in meetings during 2001-2003 will be provided during the meeting.

4.2 Data acquisition and database status

A detailed overview of the GRDC database status and data acquisition will be given, as it is summarised in GRDC Report 29: GRDC Status Report 2002

At the end of 2002 the GRDB comprises:

	Number of stations	Station-years	Values
monthly data (total)	6,395	193,944	2,327,328
original monthly data	5,330	139,512	1,674,144
original daily data	3,294	107,244	39,144,060

The following table summarises the database imports of 2001 and 2002:

year	# of countries	new daily discharge stations	imported daily discharge station years	new monthly discharge stations	imported monthly discharge station years
2001	12	766	48196	42	890
2002	14	320	16026	67	2831

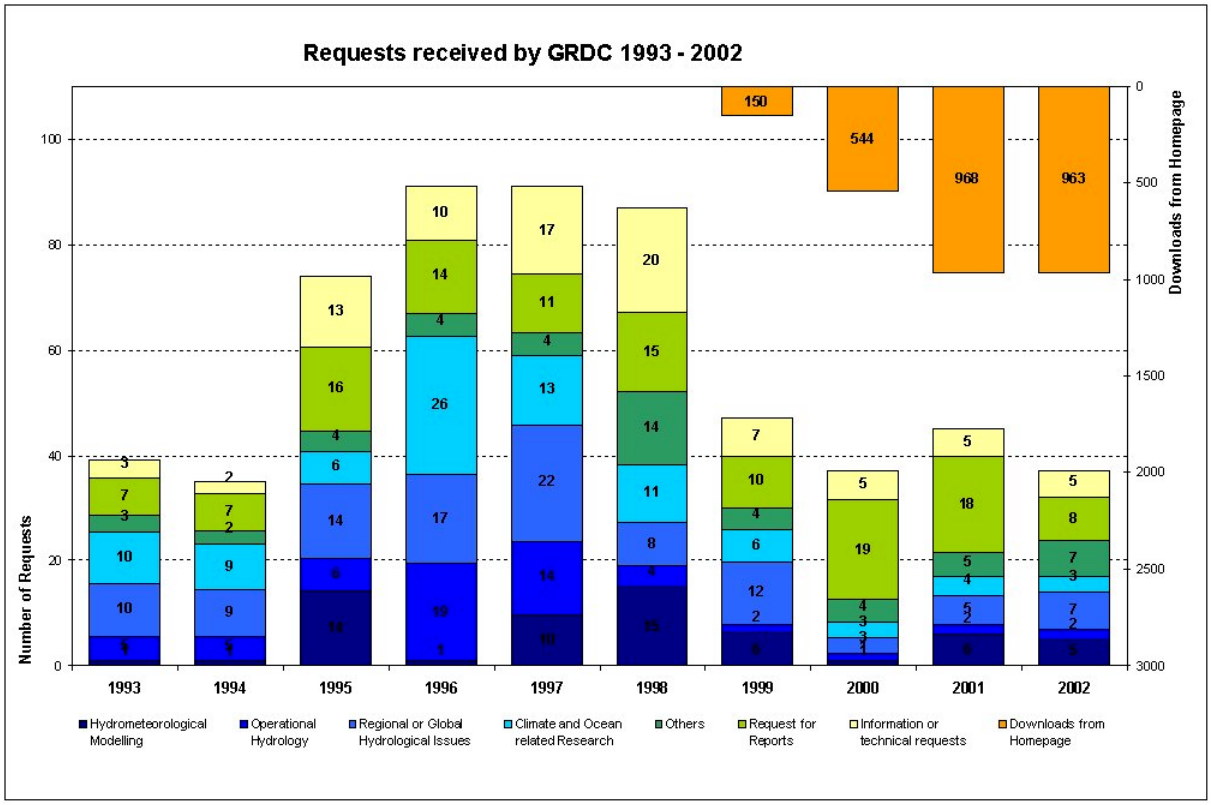
Achieving this required considerable acquisition activities (= contacts):

year	# of contacts	# of countries contacted	# of contacts/ country	# of successful countries	# of contacts/ successful country
2001	229	36	6.4	12	19.1
2002	230	44	5.2	14	16.4
2003	48	16			

4.3 Data dissemination and use

The number of enquiries to GRDC developed non-uniformly. While there has been an increase to approximately 1000 download requests the number of written requests decreased during the last years

(cf. figure below). This presumably reflects the improved and extended offer of derived data products on the GRDC homepage.



GRDC recently agreed on cooperation contracts with a number of research institutions requesting larger amounts of GRDC data. An important aspect of these contracts is the commitment to publish the research results within the GRDC Report Series.

Considerable efforts were spent to find out and list publications of research results supported by GRDC data. The result reveals, that only a small fraction of the data users report their publications to GRDC.

4.4 Developments of the database management system

An overview of the development of the database management system will be given. The database has been migrated to a central Oracle Server in BfG. Extensions of the database structure now allow to also store water level data. In a manual procedure the metadata of the roughly 6400 GRDC are in a review and extension process, including homogenisation and internationalisation of names and mapping of repeatedly used expressions like the river name to a unique ID. Furthermore the topological relation between GRDC stations along the rivers is in the process of coding, soon allowing to retrieve stations in terms of their position upstream of a specific gauge.

4.5 Data products

Two data products based on GRDC discharge data are available through the internet homepage since early 1999. The have been updated or are in the progress of being updated.

4.5.1 Long Term Mean Monthly Discharges and Annual Characteristics of Selected GRDC Stations

This GRDC data product offers statistics of 2784 discharge gauging stations in the GRDC database, selected according to the following criteria:

- station catchments have drainage area of more than 2.500 km2
- station discharge data is available for a minimum of 10 years

Calculated quantities are:

- mean, minimum, maximum monthly discharge and its standard deviation
- time series of mean, minimum, maximum annual discharge

These statistical quantities may be useful for e.g. studies in low flow analysis, flood estimations, general atmospheric modelling as well as analysis of watershed management issues.

These new statistics are an extension to the previous (1998) version, where only 1352 stations could be selected according to above given criteria. The product is now based on more than twice as much stations, namely 2784, thanks to GRDC's success in data acquisition in recent years. The statistics are stored station-wise in ASCII-files. The readability of the data format has been improved and metadata as well as data quality information has been added. See here for an example of a station statistics file. These files are region-wise compressed in ZIP-archives and can be downloaded from the GRDC homepage.

4.5.2 Mean Annual Freshwater Surface Water Fluxes into the World Oceans

Freshwater discharge from continents into the oceans is of major interest in research concerned with global monitoring of freshwater resources, the flux of matter into coastal areas and the open oceans, and the influence of freshwater fluxes on circulation patterns in the ocean and the atmosphere on regional and global scales.

Following two previous publications of estimated Mean Annual Freshwater Surface Water Fluxes into the World Oceans based on 161 and 181 discharge stations, respectively (GRDC, 1996 and GRDC, 1998) the GRDC has reworked this exercise for a third time, now based on 251 discharge stations close to the estuary, featuring basin areas greater than 25.000 sqkm. The report is expected to be published in the course of the year 2003.

Discharge from land areas not integrally captured by GRDC stations has been determined via estimating mean annual runoff coefficients (RC) by means of regionalisation from nearby monitored areas taking into account data from another 1300 GRDC stations and applying precipitation data from the Global Precipitation Climatology Centre (GPCC).

Application of GIS analysis on a 0.5 degree elevation grid optimised for flow path detection allowed to determine the catchments of all the individual grid cells that form the fringe of the continents (around 16.000), i.e. all continental grid cells were co-registered with their respective fringe grid cell through which they drain to the oceans. Furthermore, each grid cell was assigned either a calculated or estimated RC. Thus, it is possible to calculate for each fringe grid cell the integral flux from its adjacent catchment as the spatially weighted product of RC and precipitation over all co-registered grid cells. Summarising the fluxes of subsets of continental fringe cells allows to estimate fluxes for arbitrary coastline sections.

Exemplarily fluxes have thus been determined for the sub-regions defined by the Global International Waters Assessment initiative (GIWA) as well as for a global 10 degree grid. The results are compared to estimates by other authors and methods.

4.6 GRDC reports and publications

The following reports have been published since the previous SC meeting. They are available from GRDC-Homepage as PDF-file. In the future more reports documenting research based on GRDC data are expected due to recent collaborations contracts in this respect.

Report No. 27 (July 2002) Water Resources Management Country Profile Germany. A contribution to the Global Water Information Network WWW.GLOBWINET.ORG / R. Winnegge and T. Maurer (32 pp)

Report No. 28 (Nov 2002) Report of the Fifth Meeting of the GRDC Steering Committee, Koblenz, Germany, 25-28 June 2001 (36 pp, annex 300 pp)

Report No. 29 (Feb 2003) GRDC Status Report 2002 (28 pp, annex 32 pp)

)

Report No. 30 (Summer 2003) Mean Annual Freshwater Surface Water Fluxes into the World Oceans. Estimate based on data of the Global Runoff Data Centre (GRDC) and the Global Precipitation Climatology Centre (GPCC).

Maurer, Th. (2003): Challenges in transboundary and transdisciplinary environmental data integration in a highly heterogeneous and rapidly changing world - A view from the perspective of the Global Runoff Data Centre. In: Harmancioglu, Nilgun B., Ozkul, Sevinc D., Fistikoglu, Okan, Geerders, Paul (Editors): "Integrated Technologies for Environmental Monitoring and Information Production", Proc. NATO Advanced Research Workshop, 10 - 14 September 2001, Marmaris, Turkey. Nato Science Series IV Volume 23, Kluwer Academic Publishers (ISBN HB: 1-4020-1398-1, PB: 1-4020-1399-X).

Abstract:
A prerequisite for the sustainable management of the complex earth system or parts of it is a well organised environmental database. However, authority over data and information is scattered regionally and sectorally, resulting in highly fragmented approaches to their management. Researchers and managers are caught in the deadlock of either spending too much time retrieving data or omitting relevant information, both ultimately leading to stagnation. The question how to tackle this situation stands high on the agenda of international organisations as outlined exemplarily here. Finally, upcoming integrating technologies are described and promoted. A point is made that societies have to accept to spend increasing overheads for the integration of information to foster the improvement of environmental management practices.

5 WMO and CHy WG activities relevant to the work of the GRDC

Mr Grabs will provide the SC with news from Congress, Executive Council and CHy working groups.

6 Status of and opportunities for GRDC co-operations in UN-Projects and Programmes

6.1 World Climate Research Program (WCRP)

WCRP (http://www.wmo.ch/web/wcrp/wcrp-home.html) is a joint Programme of WMO, ICSU and IOC of UNESCO coordinating a couple of Projects, among them GEWEX and ACSYS

6.1.1 GEWEX: GHP, CEOP-I, ISLSCP-II

There are various GRDC activities in the framework of the Global Energy and Water Cycle Experiment (GEWEX, http://www.gewex.org/). GRDC is recognised as one of the hydrometeorological projects in GEWEX (http://www.gewex.org/projects.html). As such GRDC is member of the GEWEX Hydrometeorological Panel (GHP, http://www.usask.ca/geography/MAGS/GHP/ghp.html) and seeks to provide inputs to GHP Continental Scale Experiments (CSE) and modelling efforts by providing improved data sets. GRDC also collaborates with the GHP Data Management Working Group (DMWG, http://www.joss.ucar.edu/ghp/). The primary objective of the DMWG is to assist the GHP in the coordination and facilitation of data management activities/issues between the GEWEX Continental-scale Experiments (CSEs) and ISLSCP. Membership consists of a data management expert from each CSE and ISLSCP.

GRDC collaborates with the International Satellite Land Surface Climatology Project, Initiative II (ISLSCP-II, http://www.gewex.org/islscp.html) within the Global Energy and Water Cycle Experiment (GEWEX), where the GRDC together with the University of New Hampshire (UNH) contributed

(a) discharge data to a comprehensive data collection for the 10 year period from 1986-1995, as well as
(b) with the Global Composite Runoff Fields based on GRDC data and developed in cooperation with UNH.

GRDC participates within the GEWEX initiative CEOP (Coordinated Enhanced Observation Period, http://monsoon.t.u-tokyo.ac.jp/ceop/index.html) for the coordination of observation campaigns of all on-going and planned CSEs (Continental Scale Experiments such as MAGS (Mackenzie), BALTEX (Baltic sea area), LBA (Amazon), GCIP (Mississippi), GAME (four regions in Asia). Inputs from GRDC will be the provision of discharge data in the vicinity of the reference sites and the MOLTS (model output location time series). GRDC also is ready to receive discharge data collected in the framework of CSE.

GRDC aims at cooperation and data exchange with the hydrological data centres of the Continental Scale Experiments (CSEs). However, experiences with the BALTEX Hydrological Data Centre (BHDC) during the past years have shown the potential difficulties involved, as there exist slightly different data policies in BHDC and GRDC.

The GEWEX community frequently shows interest in estimates of "naturalized flow". This information is not easy to derive for two reasons:

- Availability of data: To date there is no comprehensive global database on man-made structures/schemes affecting water resources and its operation rules.
- Complexity of the hydrological cycle and its tight relation to the energy cycle: Estimating "naturalized flow" requires modelling. If this has to be done on a larger scale it will include processes already covered by GEWEX studies such as WEBS. It thus seems to be more reasonable to incorporate information on regional scale anthropogenic impacts into the existing water and energy balance models rather than develop an offline approach to eliminate it. Moreover, major water resources management schemes, such as the Volga reservoirs and irrigation schemes, are likely to leave their traces in other measurements of regional water and energy cycle components used for calibration of existing models.

GRDC has produced a compilation of GRDC stations close to CEOP MOLTS and reference sites. However, GRDC stresses that the flow rates measured at these stations are, at most, loosely connected to the information modelled or measured at MOLTS or REF-sites. The use of this stream flow information is thus suspected to be rather limited.

6.1.2 ACSYS/CliC

The Arctic Climate System Study (ACSYS, http://acsys.npolar.no/), being the only regional programme of WCRP, was initially implemented around 1994 and is currently supported until the end of 2003. The Climate and Cryosphere (CliC, http://clic.npolar.no/) has been implemented as a global programme. ACSYS and CliC are 2 projects that are managed by one Scientific Steering Group (SSG).

The Global Runoff Data Centre (GRDC, Koblenz, Germany) constructs the ARDB on behalf of ACSYS. GRDC's general task is to act as the global discharge inventory. GRDC is committed to this task on a long term basis rather than project oriented. Thus the GRDC is ideally suited for compiling and maintaining a runoff database of the Arctic. GRDC collaborates with the ACSYS/CliC Data Management and Information Panel (DMIP, http://acsys.npolar.no/Oelke/adis_dmip.html).

The ARDB currently consists of 2110 runoff gauging stations, 246 of which are measured on a daily basis, while the remainder is measured only on a monthly basis. The metadata of the dataset can be explored by the GRDC-catalogue tool, available from the download section of the GRDC homepage http://www.bafg.de/grdc.htm.

The monthly data in the GRDC dataset is basically a subset of the freely available Pan-Arctic river run-off data base compiled at the University of New Hampshire, USA (http://www.r-arcticnet.sr.unh.edu). However, around 100 station's coordinates have been adjusted manually due to obvious displacements revealed by visual inspection in comparison with various maps.

Since the 5th SC meeting the GRDC has succeeded in receiving an update of daily data for 17 stations of north-bound Russian rivers. Further acquisition is already negotiated. The SHI, St. Petersburg is currently digitising discharge data by means of a 8000 € fund by BfG. Furthermore updates from Canadian stations are expected to arrive at GRDC according to the 5 yearly update procedure in place.

Data of the ARDB is easily accessible. However, due to GRDC's data policy of free and unrestricted but identified access, limited to non-commercial applications, ARDB data is presently not available online but an interested user has rather to adhere to the established GRDC procedures. For ACSYS members the service is free of charge.

6.2 WHYCOS

The goal of the World Hydrological Cycle Observing System WHYCOS (http://www.wmo.ch/web/homs/projects/whycos.html) is to finally arrive at a network of approximately 1000 stations around the globe that deliver hydrological and meteorological as well as environmental quality data. The current concept is the development and implementation of regional HYCOS projects addressing specific needs of the regions involved. This regional approach makes it easier to secure funding for the projects. All regional HYCOS projects however are implemented under a global perspective and ultimate global exchange of the data and information generated in the regional projects.

In the Eleventh Session of the WMO Commission for Hydrology in Abuja, Nigeria, 6-16 November 2000 under item 13.12 it was stated that WHYCOS projects are urged to embrace the principles and intent of Resolution 25 (Cg-XIII) – Exchange of hydrological data and products by making available the hydrological data and supporting metadata beyond the bounds of the particular HYCOS initiatives which include the appropriate WMO global data centres in accordance with agreed standards.

At the 5th SC the view was expressed that each HYCOS is obliged to forward its data to the GRDC. However data exchange with HYCOS projects is not straightforward, as e.g. MED-HYCOS was

started before WMO Resolution 25 became active and thus now many participating countries do not agree to publishing their data..

6.3 IGOS Water Cycle Theme

IGOS was launched in 1998 in order to unite the major satellite and surface-based systems for global environmental observations of the atmosphere, oceans and land in a common framework including the G3OS. (Further details are available from http://www.igospartners.org/)

The IGOS Partners accepted the IGOS Integrated Global Water Cycle Observation (IGWCO) theme to be developed. The WCRP took the lead in developing a proposal for IGWCO. An integrated water cycle observational system will bring together the capabilities of both satellite based and ground based observing systems. These observing systems would support research activities dealing with the role of the atmospheric water cycle in climate, and prediction systems. In addition, networks and systems for monitoring surface and sub-surface water cycle components such as streamflow and soil moisture are integrated to provide background information on the impacts of variability and trends in the global water cycle.

A series of three workshops has been held between January and March 2003, one in the US in early January 2003 on surface hydrology, another in Japan on precipitation in mid March 2003 and one held by ESA in the period March 5-7 at ESTEC, Noordwijk in the, which centred on applications related to the water cycle, such as extreme events, water availability, water quality, resource management - such as hydropower, planning and land use - , permafrost/climate, NWP and climate modelling, etc. The purpose of the workshops was to define priorities, specific ideas and approaches for incorporation in the final report. GRDC attended and contributed to the second workshop in the Netherlands, stressing the aspect of developing hand-in-hand with new observing capabilities a thorough metadata structure to ensure the access to the ever growing amounts of data.

Workshop outputs are yet pending.

6.4 GCOS

6.4.1 GTN-H (Global Terrestrial Network for Hydrology)

GTN-H, the Global Terrestrial Network for Hydrology is a recently started initiative of WMO and GCOS. The goal is to present world-wide near real time (NRT) data of 10 hydrological variables. GRDC participates in GTN-H aiming at contributing the discharge component.

The project has been recognised during the Eleventh Session of the WMO Commission for Hydrology (CHy) in Abuja from 6-16 November 2000 (see items 19.1.17-19 of the CHy report).

Several meetings have taken place to develop an implementation strategy:

- Establishment of a Hydrological Network for Climate, Geisenheim, 26-30 June 2000. Report available at http://www.wmo.ch/web/homs/documents/english/geisenheim.pdf.
- Expert Meeting on the Implementation of a Global Terrestrial Network-Hydrology (GTN-H), Koblenz, 21-22 June 2001. Report available at http://www.wmo.ch/web/gcos/Publications/gcos-71.pdf.
- From 18-20 November 2002 a subsequent WMO Expert Meeting on "Hydrological Data for Global Studies" was held in Toronto, Canada, followed by a meeting of the GTN-H coordination panel from 21-22 November again in Toronto. Reports of these two meetings are yet in draft stage.

At these meetings it was recognized that there is a critical need for improved availability and access to global hydrological data, information and products for climate and hydrological research and

applications in order to quantify key environmental change processes, identify significant trends, assess variability and develop response strategies. The GTN-H would consist of existing networks, global databases and global data product centres, capturing ten key hydrological variables. The following are the main objectives for the network:

- Respond to urgent information requirements with regard to climate prediction, impacts and adaptation, including the characterisation of hydrological variability to detect climate change.
- Assess water sustainability as a function of water use versus water availability,
- Improve understanding of hydrological processes.

One of GRDC's contributions to GTN-H will be the creation of an internet based Near Real Time (NRT) Monitor tool for discharge data (GRDC NRT-Monitor).
The core of the project will be a software to collect NRT-discharge data from distributed sites in the internet and make it available in a harmonised way via the internet and a software to display the collected and harmonised NRT-discharge data graphically in a web page by means of an internet map server similar to the USGS WaterWatch (http://water.usgs.gov/waterwatch), that displays the occurrence probability of the currently measured NRT-discharge values based on the long term characteristics.

It is expected that the benefit of such a system to provide easier, unified access to information on NRT discharge data will serve as a stimulating good example for the international exchange of hydrological data by providing a visible platform.

Previous achievements that GRDC intends to apply in this project are a prototype of a NRT-Monitor that has already been developed by GRDC in the framework of the European Flood Forecasting System (EFFS) and an Internet Map Server (IMS) which is available at the BfG and which will be made available to implement the planned mapping facility.

6.4.2 2nd Report on the Adequacy of the Global Climate Observation Systems

The Second Report on the Adequacy of the Global Climate Observing Systems has been published. GRDC was contributing author and is pleased to see the issues of "Effective Data Exchange and Access", "Standards" and "Planning and Reporting" being highlighted at prominent position, i.e. in Conclusion 2+3 and 12-15 of the Executive Summary.

6.5 UNESCO/IHP

IHP, being the follow-up of the International Hydrological Decade (IHD) that lasted from 1965-1974 is defined in phases. Currently we are in phase VI from 2002-2007. These are the major themes:

Theme 1:	Global Changes and Water Resources
Theme 2:	Integrated Watershed and Aquifer Dynamics
Theme 3:	Land Habitat Hydrology
Theme 4:	Water and Society
Theme 5:	Water Education and Training

HELP (http://www.nerc-wallingford.ac.uk/ih/help/) and FRIEND (http://www.nwl.ac.uk/ih/www/research/bfriend.html) are regarded as essential cross-cutting components of phase VI of the IHP .

6.5.1 FRIEND

Mr Gwyn Rees, CEH, will provided the SC with a summary report on the UNESCO/IHP Programme "Flow Regimes from International Experimental and Network Data Sets" (FRIEND, http://www.nwl.ac.uk/ih/www/research/bfriend.html)

Since 1993, co-operative activities have been envisaged and carried out. These activities include participation of FRIEND representatives in GRDC-SC meetings and vice-versa.

GRDC is acting as Regional Data Centre of the North European component of the UNESCO/IHP Programme "Flow Regimes from International Experimental and Network Data Sets" (NE-FRIEND). It is responsible for the data acquisition for five central European countries, i.e. Germany, Austria, Switzerland, Czech Republic and Slovakia.

The German National IHP/OHP Committee supports database activities of GRDC in FRIEND projects in its Working Group on FRIEND/ERB (European Network of Experimental and Representative Basins, http://www.ih.savba.sk/ihp/friend5/erb7.htm).

FRIEND-GRDC collaboration in data acquisition and metadata compilation

At the 5th SC meeting GRDC was encouraged to contact individual FRIENDS and try to collaborate in data acquisition and metadata compilation. Thus at the 8th Northern European FRIEND Steering Committee meeting, held on 18 March 2002 in Cape Town, South Africa, GRDC presented a proposal entitled "Creation of a common metadatabase on world-wide runoff stations compiled from the individual FRIEND databases, the GRDC database and possibly other sources", which was included in a Technical Note circulated prior to the meeting. GRDC also presented the proposal to the Southern African and West and Central African Steering Committees. It was argued that a global metadatabase would provide an improved overview and accelerated access to data by summarising standardised information on the data available, even if it is held elsewhere. It was proposed that GRDC would maintain such a global metadatabase, but stressed the need to agree at the outset on a standardised list of metadata-entries (= catalogue columns) to ensure success. The meeting agreed to support GRDC's proposal and decided that the Database Group would liaise with GRDC on this issue
Alan Gustard, Chairman of the NE-FRIEND SC, suggested that the number of fields in the catalogue be kept close to 5-6 items with information on each station; Thomas Maurer favoured 8-10 items.

GRDC favoured establishing a FRIEND working group to coordinate this activity. GRDC felt the working group should ideally be composed of representatives from all contributing parties (in the first instance: Regional FRIEND Groups and GRDC) with the objective to decide on a standardised list of metadata-entries (= catalogue columns) as a prerequisite for successful compilation of the metadatabase. It was suggested that GRDC could liaise directly with each FRIEND Group. It also was suggested to discuss the matter further with the Chair of the FRIEND Inter-Group Coordination Committee (FIGCC), Eric Servat. A representative of FIGCC, Mr Alain Dezetter, will be available during the SC meeting**.**

Transfer of the management of the European Water Archive to GRDC

The Project Group 1 on Databases of the Northern European FRIEND held a Group Meeting in Cape Town on 21 March 2002 lead by the Coordinator/Chairman Gwyn Rees from the Centre for Ecology and Hydrology Wallingford, UK. One of the three items discussed was the transfer of the management of the EWA from CEH to another organisation:

- GRDC indicated willingness to assume this role, subject to being aware of (and accepting) the technical and administrative demands, i.e. GRDC would need to know what was involved in the role
- Concern was raised if there were any potential conflict between GRDC's status as a WMO data centre and it being responsible for the a database that is a constituent of the UNESCO IHP. It was pointed out that GRDC wouldn't be able to enforce the provision of data to the EWA.
- The provision of data to FRIEND would continue to be on a voluntary basis and GRDC would need to clearly distinguish between the two datasets and ensure that the conditions for the dissemination of FRIEND data are strictly adhered to.
- The representative of AMHY confirmed that AMHY data presently held on the EWA could be forwarded to GRDC, should they assume the role of EWA Coordinators.

- There were no objections in principle to the GRDC assuming the role of EWA coordinators.
- It was agreed that Mr Rees and Mr Maurer should discuss the likely commitments and, subject to satisfactory outcome, agree a time-table for hand-over

The latter is currently pending. However, GRDC is still prepared to take over this task.

6.5.2 HELP

Ms Camille Talayssat, UNESCO, will brief the SC on the status of the joint UNESCO/WMO Programme "Hydrology for the Environment, Life and Policy" (HELP, http://www.nerc-wallingford.ac.uk/ih/help/)

HELP is designed to establish a global network of catchments to improve the links between hydrology and the needs of society. As a cross-cutting programme of the UNESCO International Hydrological Programme, HELP is expected to contribute to the World Water Assessment Programme (WWAP), and the Hydrology and Water Resources Programme of WMO.

6.6 WWAP/WWDR

After release of the first edition of the WWDR at the occasion of the WWF3 in Kyoto, Japan, in March 2003 Mr Jimbow will give a presentation on the status and further planning of the World Water Assessment Programme (WWAP, http://www.unesco.org/water/wwap/),.

The WWAP has been established as a joint effort composed of 23 partners of UN systems (Programmes, Agencies, Regional commissions, Conventions and Decades) supervised by the Subcommittee on Water Resources (SCWR) which is integrated in the High Level Committee on Programmes (HLCP) under the United Nations System Chief Executives Board (CEB) for Coordination (http://ceb.unsystem.org/). (Is this still the coordination mechanism?)

The Secretariat was opened in spring 2000 and is located at UNESCO headquarter in Paris. Financial foundation is provided by national governments (major share by Japan), institutions, NGO, etc.

The WWAP has four major activities, namely

- the biennial World Water Development Report (WWDR),
- an Information Network,
- a Capacity Building component,
- Applications, mainly in the area of water conflict resolution.

As reported in the 5th SC meeting GRDC had participated in two preparatory WWAP-workshops, namely on “Models and Modelling” in Colombo, Sri Lanka, in December 2000 and on “Data and Databases” in Geneva, Switzerland, in January 2001. GRDC had offered to contribute to the report by its data and by application of the WABAL methodology in the context of case studies requested for the WWDR. At the 5th GRDC SC meeting it was stressed that GRDC, as WMO's operative organisation needs a clear picture of what it can contribute to WWAP and the WWDR. The SC encouraged the GRDC to closely liaise with WWAP in relevant aspects of information management.

The 1st WWDR was produced under serious time pressure, thus besides developing a network pragmatically concentrated on goals that promised to be achievable the limited time span of around two years. Activities aimed at building long lasting fundaments such as a sound and comprehensive database where not lost out of sight but maybe for the time being ranked slightly lower in the first period. After release of the 1st WWDR this seems to have changed now.

According to recent communications with Gordon Young and Bhanu Neupane more emphasis is planned to be put on what is called the WWAP data system. WWAP wants GRDCs to be part of it early on for the second phase.

WWAP requested GRDC to present on "Intergovernmental arrangements and problems of data sharing" at the Monitoring Tailor Made Workshop in The Netherlands in September 2003 (http://www.mtm-conference.nl/) an event that is been sponsored among others by WWAP

6.7 UNEP

Mr Fraser will give an information on developments at the Division of Early Warning and Assessment (DEWA) of the United Nations Environment Programme (UNEP)

6.8 Global data centres

6.8.1 GWPO (GEMS/Water Programme Office)

Mr Fraser will give a presentation on the status of the GEMS/Water Collaboration Centre (GWCC, http://www.cciw.ca/gems/).

GRDC and GWCC are mutually promoting their respective data sampling missions. Joint programs have been envisaged and undertaken following an earlier working agreement between GWCC in Burlington and the GRDC and an agreement at the GTN-H implementation meeting just before this meeting (see agenda item 8.4). Collaborative activities relate to an update of the joint metadata catalogue for users produced in late 1998, describing measuring stations at rivers which are common in both databases (or close, as stations tend to be maintained by different authorities). Using GEMS and GRDC data, further steps envisaged are the calculation of suspended sediment load of selected rivers to the world oceans, basin assessments of water quantity and quality, and data acquisition depending on the availability of resources of GEMS and GRDC.

6.8.2 GPCC (Global Precipitation Climatology Centre)

Mr Rudolf will give a presentation on the status of the Global Precipitation Climatology Centre (GPCC, http://www.dwd.de/research/gpcc/) located at the German Weather Service DWD (http://www.dwd.de).

GPCC is operated by the Deutscher Wetterdienst (DWD, National Meteorological Service of Germany) and was established in 1989 at the invitation of WMO as a German contribution to WCRP. The Centre supports the Global Precipitation Climatology Project (GPCP), the Global Climate Observing System (GCOS), and the Arctic Climate System Study (ACSYS). GPCC is active in the GHP and is a component of the GCOS/GTOS Terrestrial Network – Hydrology (GTN-H).

GPCC regularly collects monthly precipitation totals for about 7,000 stations worldwide via the WMO World Weather Watch Global Telecommunication System (GTS). GPCC also acquires additional precipitation data from national weather services, hydrological institutes etc. to enlarge the database. Thus far, institutes from about 160 countries have supplied additional data on a voluntary basis, following WMO requests and bilateral negotiation with GPCC. GPCC's full database in-cludes monthly precipitation totals of more than 50,000 stations for which monthly precipitation data are available in the period since 1986.

The monthly GPCC products, gridded data sets based on rain-gauge observations, are available in two resolutions, 2.5° by 2.5° and 1.0° by 1.0° geographical latitude and longitude, and for two different databases, i.e. near real-time based upon GTS data only (GPCC Monitoring Product) and non real-time including complemented GTS data, and additionally, the data delivered later by national institutions (GPCC Full Data Product). A re-analysis based upon the expanded database (Full Data Product) has been carried out for the period January 1986 up to December 1995 (ca. 28,000 to 40,000

stations). The results have been calculated on a 0.5°-grid (and 1°-grid) and have been provided in January 2002 to NASA/GSFC for publication on the ISLSCP-II CD-ROM.

The Full Data Product delivers sharper gradients due to the higher station density compared to the Monitoring Product. The differences of monitoring and full data precipitation are large where the precipitation itself or the gradient is large, and where the Full Data Product is based on significantly more rain gauges than the Monitoring Product. One reason may be that the heavy rainfall areas, which generally are quite local in extent, are depicted better by a dense station network. However, interpretation of the differences is complicated by the effect of possible errors in the precipitation data of the "Full Data Product", which have not been manually quality-controlled as for the "Monitoring Product". Therefore more research is required before a recommendation pointing toward any one of the two products can be given.

There is a strong demand from the international research community for analyses of daily precipitation. However, going from monthly to daily precipitation analyses, as well as from a 2.5° to a 1° resolution will increase the uncertainties of the analysis products as a con-sequence of the larger variability of daily compared to monthly precipitation fields and the reduced spatial sampling (less stations per grid). The database is fairly sufficient for Europe for daily precipitation analyses on a 1°-grid, but for most other regions it is clearly insufficient. Another hindering problem are the different precipitation observation and daily summation times in different parts of the world, so that it is not possible to derive a complete global land-surface analysis of daily precipitation from rain-gauge data.

The GPCC started daily precipitation analyses on a 1°-grid for Europe (31°-72° N, 11°W-44°E) on a routine basis with January 1st 2001. The heavy rainfall leading to the extreme Elbe flooding in August 2002 has been analyzed. Preliminary reports (in German) including maps are available on the internet at: http://www.dwd.de/de/FundE/Klima/KLIS/prod/spezial/regen/index.htm. Reports on earlier flooding events, i.e. Odra, 1997, Yangtze, 1998, Wisla, 2001 can also be found there.

A new operational method for correction of daily gauge data due to systematic measuring errors has been developed at the University of Vienna (F. Rubel) in the framework of BALTEX. The new method for on-event correction is based on synoptic data and has been extended for applications on a global scale in co-operation between Dr. Rubel and GPCC. This method was adapted for the GPCC to correct global daily rain gauge measurements routinely transmitted via GTS.

Intercomparison studies between Legates' climatological correction and the on-event correction method have been carried out for the regions of the GEWEX Continental Scale Experiments except MAGS. Overall the new method gives slightly lower correction factors than Legates' bulk correction, mainly because Legates' method seems to have a tendency to overestimate the correction in the case of snowfall, but also for intense tropical rains. Up to now the new method is not applicable in the GPCC Monitoring or Full Data Product because the method requires the full information from SYNOP data, which is not available from the large collective of raingauge-only stations. The development and implementation of an interpolation technique for the SYNOP-based correction factors to non-SYNOP stations is planned for the current year.

The GPCP operationally provides a new product of daily global precipitation on a 1° by 1° grid (http://www.ncdc.noaa.gov/wdcamet-ncdc.html) termed GPCP-1DD (satellite-based, adjusted on a monthly basis to match the GPCC analysis). The GPCC validates this product regionally using precipitation data being collected for the Baltic Sea Experiment (BALTEX) and for the Mesoscale Alpine Project (MAP) from national high-resolution surface networks. A more detailed study investigating the occasional discrepancies between GPCP-1DD and rain gauge analyses with regard to large-scale synoptic patterns is based on the daily high-resolution gauge analyses for the BALTEX area for the 4-year period 1996–1999. This study will be completed in 2002.

A research project Variability Analysis of Surface Climate Observations (VASClimO), which is funded by the German Climate Research Programme (DEKLIM), began in October 2001 in co-

operation with GPCC and the Institute for Meteorology and Geophysics, University of Frankfurt/Main. The two main goals of VASClimO are: 1) the compilation of a comprehensive global climate data base for precipitation, snow cover, surface air temperature (average and extremes) and mean sea level pressure, including existing historical data collections and additional data to be acquired, and 2) a detailed statistical analysis of the data set.

GPCC is funded by the German Polar Research Programme to continue operation of the Arctic Precipitation Data Archive (APDA). The new project (follow-up to an earlier ACSYS-APDA project) began on 1 September 2002 and will continue until March 2005. Its aim is to collect and analyse snow depth data and to develop an improved Arctic precipitation climatology.

GPCC is heading for the inclusion of 17.000 stations from the Global Historical Climatology Network (GHCN, http://cdiac.esd.ornl.gov/ghcn/ghcn.html) that holds data beginning from 1840. Another 9.000 stations are expected to become available via the Climatic Research Unit of the University of East Anglia (CRU, http://www.cru.uea.ac.uk/) that date back to 1890.

The SC recommendation, that future collaborative work should include the cross-validation of GPCC and GRDC data, e.g. by determination of monthly runoff coefficients for GRDC basins has been started in the context of the GRDC Study "Mean Annual Freshwater Surface Water Fluxes into the World Oceans".

6.8.3 IGRAC (International Groundwater Assessment Centre)

Mr van der Gun will give a presentation on the status and further planning of the International Groundwater Assessment Centre (IGRAC).

The 14th Intergovernmental UNESCO-IHP Council (June 2000) adopted Resolution XIV-11 and the 11th Session of the WMO Commission for Hydrology (November 2000) adopted Recommendation 1 (CHy-XI), both with regard to the establishment of an International Groundwater Resources Assessment Centre. The Netherlands Institute of Applied Geoscience TNO has been proposed to establish and accommodate IGRAC. Funding has been provided by the Dutch Government and IGRAC was inaugurated at the WWF3 (?).

7 Other Collaborations

7.1 Research groups working with GRDC data

7.1.1 Oregon State University (ongoing)

Topic of Research Proposal: Study and examination of the influences of hydrologic variabilities and extremes on water related political conflicts and cooperation in international river basins.
Research Project Summary: The research project aims to develop discharge and precipitation derived hydrologic parameters, which describe the variability, extreme events and changes over time as they are important to human perception. These parameters will be related to intensity-coded events of conflict or cooperation over water, collected in a GIS based database by Prof. Dr. Aaron Wolf and his team at Oregon State University. This will provide an unique opportunity to study the link between hydrologic conditions and water related political conflict and cooperation.
For this study GRDC provides the requested relevant daily and monthly discharge data, all together 965 daily and 1603 monthly data sets free of charge. Based on the data of the GRDC, OSU will develop a data set of hydrological parameters (considering flow regimes, variabilities, anomalies, flood and drought events etc.) and thus characterising the international river basins of the world. These parameters will be related to the intensity-coded events of conflict or cooperation over water as available from the Transboundary Freshwater Dispute Database (TFDD). OSU will provide - until September 2003 - the GRDC with an electronic version of a project report in English language to be

published in the GRDC Report Series under the authors name(s). The report will elucidate the developed data set of hydrological parameters and also will draw conclusions related to international cooperation in the management of the international river basins. Optionally, depending on the success, the report will also cover the results obtained from the correlation efforts of the hydrological parameters and the coded political parameters of the TFDD.

7.1.2 TU Dresden (ongoing)

Topic of Research Proposal: Development of a physically consistent system model for the examination of rotation, morphology and gravitation field of the earth
Short Title: Earth system model
Research Project Summary: In the scope of her dissertation Ms C. Walter will examine the impact of continental hydrology on the parameters of the rotation of the earth and the gravity field. Integral part of the research will be thus the modelling of the global water cycle. Within the project the hydrological discharge model HDM by S. Hagemann will be used, driven by ECHAM4- (years 1903-1994)and NCEP (years 1948-2001) data. GRDC data will be used for validation of HDM.

7.1.3 University of Tokyo (ongoing)

Topic of Research Proposal: Estimating hydrological extremes of the 20th century in major river basins: Inter decadal and inter annual variation of seasonal flood and drought (PhD-thesis of Ms Yukiko Hirabayashi)
Short Title: Hydrological extremes in the 20th century
Research Project Summary: As outlined in detail in the attached research proposal, the proposed study aims to globally validate numerical river water simulations for the past 100-year.
As the focus of the research is on the reproducibility of return periods of heavy flood and/or drought events in large river basins, relatively long time series of discharge data are required for the analysis (10 -100 years). Data from the GRDC database allows to compare calculated river discharge by our model (land surface model + river routing scheme at 0.5 degree) to real observations.

7.1.4 University of Tokyo / GSWP2 (ongoing)

Topic of Research Proposal: Streamflow validation among GSWP-2 participating LSMs during 1986-1995: a part of the validation activity of GSWP-2
Short Title: GSWP-2 streamflow validation of LSMs during 1986-1995
Research Project Summary
Research Project Summary: GSWP-2 is an offline land-surface modeling and evaluation effort conducted at a spatial resolution of 1 degree. GSWP-2 is the follow-on project to GSWP-1, a 2-year pilot phase based on the ISLSCP Initiative II data set for 1987-88
As outlined in detail in the attached research proposal, goals of the proposed study are to:

- Produce state-of-the-art global data sets of soil moisture, surface flux, and related hydrologic quantities.
- Develop and test large-scale validation techniques over land.
- Provide large-scale validation and quality check of the ISLSCP data sets.
- Compare land surface models (LSMs), and conduct sensitivity studies of specific parameterization, which should aid future model development.

GSWP-2 is closely linked to the ISLSCP initiative II data effort, and LSM simulation in GSWP-2 will encompass the same core 10-year period as ISLSCP initiative II (1986-1995).
There are five basic categories of participants in GSWP-2: the operational centers, the land-surface modelers, validators of the model output, those involved in remote sensing applications, and other users of the model output.
As a part of the validation activity in the project, hydrologic validation is performed on basin-integrated model runoff against observed streamflow and discharge.
Data from the GRDC database is expected to provide ‘true value’ of the streamflow for the validation.

7.1.5 University of Washington (ongoing)

Topic of Research Proposal: Study and examination of the Adjustment of Gridded Precipitation for Orographic Effects (NASA Grant NAG5 – 9416, University of Washington).
Research Project Summary: As outlined in detail in the Research Proposal, the proposed study aims to develop an orographic correction for global (terrestrial) gridded precipitation, focusing on the years 1979 through 1999. In order to develop a correction for the underestimation of gridded precipitation in mountainous regions, a hydrologic approach is being envisaged. Following this approach, an adjustment to the precipitation in orographically-influenced drainage basins is being undertaken using a combination of water balance and the Budyko ET/P vs. PET/P curve.

7.1.6 Polish Academy of Science, Poznan (ongoing)

Topic of Research Proposal: Trend analysis of long global discharge time series'
Research Project Summary: Prof Zbigniew Kundzewicz from the Research Centre for Agricultural and Forest environment was given by WMO/HWR the duty to study long time series of hydrological records from as many rivers, globally, as possible in the scope of an activity within the World Climate Programme-Water.
The task is, among others to analyse long time series of hydrological data, seeking eventual changes or trends. For this purpose time series' with a global spread of annual maxima of daily data of at least 40 years were required. 1113 GRDC stations featuring more then 40 years of data were delivered.

7.1.7 Bundesanstalt für Geowissenschaften und Rohstoffe, Federal Institute for Geosciences and Natural Resources (under negotiation)

Topic of Cooperation Project: Verification, extension and attributation by discharge data of a map representation of the major global streams in the context of the generation of a hydrogeological map of the world within the scope of the World Hydrologeological Mapping and Assessment Programme (WHYMAP).
Short Title: Discharge mapping for WHYMAP
Project Summary: As outlined in detail at http://www.iah.org/whymap, the Commission on Hydrogeological Maps of the International Association of Hydrogeologists (IAH) in cooperation with the International Hydrological Programme (IHP) of UNESCO and the Commission for the Geological Map of the World (CGMW) has launched the World Hydrologeological Mapping and Assessment Programme (WHYMAP).
The programme is a major IAH initiative for the World Water Forum in March 2003 in Kyoto. IAH, through BGR Hannover, has been leading a project (through Willi Struckmeier) on behalf of UNESCO and the World Water Assessment Programme (WWAP). The full project will be completed in 2004 and the final WHYMAP scale 1:25 M is planned to be presented in August 2004 at the International Geological Congress (IGC) in Florence. Moreover, in autumn 2003 a "Workshop on Hydrogeological Maps" is planned in Hannover/ Berlin.
The objectives of WHYMAP are to

- summarise groundwater on a global scale (1:25,000,000 scale)
- do this through a geo-referenced information system (GIS)
- provide map based information on groundwater to contribute to international understanding of world water systems, e.g. in the World Water Assessment Programme (WWAP) and their World Water Development Report (WWDR)
- provide a contribution to the proposed International Groundwater Resource Assessment Centre (IGRAC)

7.1.8 University of Greifswald (under negotiation)

Topic of Research Project: Improved models fore time series components by identification of large scale patterns in seasonal and long term components of global discharge time series'.

7.1.9 University of Bonn (under negotiation)

Topic of Research Project: Examination of extreme precipitation and flood events in Europe during the past 100 years.

7.1.10 University of Kassel (finished)

Topic of Research Project: Global Water Assessment and Prognosis model WaterGAP, which also accounts for water uses (http://www.usf.uni-kassel.de/english/personal/petrasub/watergap.htm, in cooperation with the Center for Environmental Systems Research, University of Kassel, Germany).

7.1.11 University of New Hampshire (finished)

Topic of Research Project: Global Composite Gridded Runoff Fields (http://www.grdc.sr.unh.edu)

7.2 European Flood Forecasting System (EFFS)

Mr Maurer will give a brief presentation on GRDCs contribution to the European Flood Forecasting System (EFFS)

The European Flood Forecasting System (EFFS) project contributes to the Energy, Environment and Sustainable Development Programme for Research, Technology development and Demonstration (RTD) under the fifth Framework Programme of the European Commission.

The EFFS project aims at developing a prototype of an European flood forecasting system for 4-10 days in advance that takes advantage of currently available Medium-Range Weather Forecasts e.g. from the European Centre for Medium-Range Weather Forecasts (ECMWF http://www.ecmwf.int/). This system will provide daily information on potential floods.
This activity is currently extended in the LISFLOOD ALERT project at Ispra, Italy.

The task of the GRDC was to provide the project with Near Real Time runoff data for the example catchment of the Rhine river. In the framework of the project GRDC developed a prototype of a data integrating platform that will also be the basis for further endeavours of the GRDC with respect to the GTN-H.

7.3 GLOBWINET – co-operation in an Associated Programme (AP) of the Global Water Partnership (GWP)

GLOBWINET (http://www.globwinet.org/) is one of the Associated Programmes of the Global Water Partnership (GWP, http://www.gwpforum.org) in the context of Integrated Water Resources Management (IWRM). GLOBWINET is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ, http://www.bmz.de/en/index.html) and implemented by the German Agency for Technical Cooperation (GTZ, http://www.gtz.de/english/). In this project GRDC is a subcontractor of GTZ, responsible for triggering the provision of quality information on the German water resources sector for GLOBWINET.

GLOBWINET aims to provide an information platform for integrated water resources management. Basically, it is an internet-accessible database of water-administration related information around the globe which can be fed and administrated in a decentralised fashion. It links the names of individuals, organisations and text materials. At present, the South African component SAWINET and the German component GEWINET are under development.

GRDC has been charged with building a "Water Resources Management Country Profile Germany", i.e. a concise compilation that provides easy access as a whole to various scattered and fragmented

sources already reporting on different aspects of the German water management sector (GRDC Report 27). The core chapters of the report deal with "Geography and Hydrology", "Structures and Co-operation in Water Resources Management", "Legal Framework for Water Planning and Management" and "Usage of Water" in Germany. The electronic version of the report allows to directly link to the web-pages of most of the cited sources.

GRDC will present GLOBWINET at the Sixth Water Information Summit (http://www.irc.nl/news/wis6.html) that will be held in The Netherlands in September 2003, an event that is been sponsored among others by WWAP

More recently GRDC's focus within GLOBWINET shifted again towards SAWINET in the South African region.

7.4 IFNet (International Flood Network)

The International Flood Network (IFNet) has as its objective to facilitate international cooperation in flood management.

- to reduce the loss of life and damage caused by floods
- to promote policies and practices which can break the vicious circle of poverty and environmental degradation and lead to a safe and sustainable future

Background

- There must be a shift of emphasis from reactive to proactive action.
- Flooding is often a very local problem that can benefit from natural and international assistance if this can be mobilized.

IFNet facilitates the identification and solution of problems, without imposing on the rights of the local and national authorities concerned.

Activities

(1) The exchange of information, experience, technical knowledge and future plans with the aim of enhancing co-operative concrete action.
(2) Raising public awareness of floods by compiling and disseminating information and views on such aspects as health, culture, education, gender and so on.
(3) Establishing floods high on the international agenda, and producing periodic newsletters and reports on flood-related activities and commitments.

8 Metadatabases

The topic of metadata has been on the agenda since several years and attracts growing attention by the international research and assessment community in all fields of geophysics, thus reflecting the urgent need to arrive at improved ordering schemes and decreasing access times for a given information.

Coherent with this development, in the Eleventh Session of the WMO Commission for Hydrology in Abuja, Nigeria, 6-16 November 2000 under item CHy-XI-11.8.2, GRDC was requested to consider setting up a global meta-database, starting with 200 discharge stations and further the set-up of an internet-based metadata information system (physical and topographic features of basins, land use and hydrology).

GRDC has maintained a table of metadata for a long time, which together with a browsing tool is available for download from its homepage for several years now. For all its > 6400 stations this table comprises the following information:

- GRDC station no
- station name

- river name
- basin name
- country name
- latitude
- longitude
- altitude
- basin size
- daily data available from
- daily data available until
- percentage of missing values (daily data)
- monthly data available from
- monthly data available until
- percentage of missing values (monthly data)
- mean annual streamflow

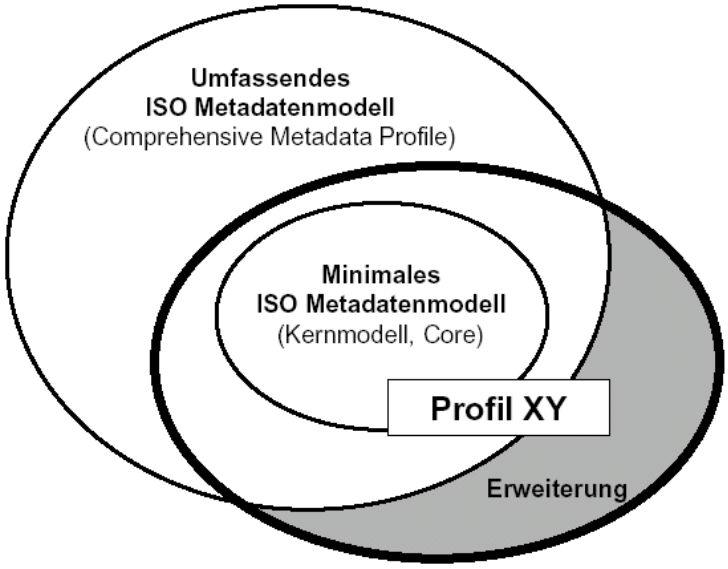
At the 4th Steering Committee meeting 1999 SC recommended that a template for metadata should be developed (item 23.12-23.18). Annex 16 of the GRDC-SC-1999 (GRDC Report 23) furthermore gave a summary report of a meeting entitled "Proposal for the Establishment of a Global Hydrological and Water Resources Meta-Database". Based on this proposal, CHy-XI requested GRDC to consider setting up a global meta-database extending station information as well as catchment information. 5th SC was of the view that GRDC should not work towards this goal alone but rather join forces together with other ongoing activities and organisations.

Current issues:
Integration efforts for geographic data and information are already much advanced, i.e. by development of the metadata standard ISO 19115 of ISO/ TC 211 on Geographic Information/ Geomatics. Since 8 May 2003 ISO 19115 is in stage 60.60 (i.e. International Standard Published). Many organisations are now developing new or are migrating their existing metadatabases on geographical information to ISO 19115 conformity. The developments achieved there may serve as a template for a more general approach for information integration of observations of geophysical processes of any kind, including river discharge.

Some Background on ISO 19115
(taken from http://www.ned.dem.csiro.au/research/visualisation/metadata/geospatial):
ISO 19115 describes 411 elements (attributes) used in 95 entities (classes). The structure and relationships between the components are shown using 14 UML diagrams and the definitions given in a tabulated dictionary in 14 sections. Both the UML and dictionary are Normative. The entities or classes are grouped in 5 packages, Metadata, Lineage and Data Quality, Extent and Citation, which are thus also available for use in other TC 211 standards as appropriate. The obligation of the various entities or classes is quite variable and flexible, and the structure of ISO 19115 metadata is complex.

The scope of the information covered by ISO 19115 is broadly that needed for a user to identify, evaluate, select, obtain, and possibly use the datasets described. The level of detail is much greater than other standards and the manner in which it is provided is much more structured. The content models are elaborate and hierarchical, and for those elements that still contain text, the information is generally disaggregated more finely. This supports the construction of more elaborate interfaces and more finely controlled queries, but places a much greater burden on the metadata provider and tool developer. ISO 19115 attempt to cover the needs of a wide range of potential applications, but at the cost of a rather daunting structure. Rules are given on how to define a **community or domain profile** which limits the elements used or the values or obligations of components of the standard, and also on how to add specialised extensions where it is found that the requirements are not satisfied by the components already defined in ISO 19115 (though the need for the latter is considered minimal and clearly discouraged!).

However, the ISO 19115 specification also summarises the generic core metadata comprising the minimum elements that satisfy the requirements of an ISO conformant metadata record. Examples of core metadata records end up containing a comparable amount of information as a typical record by other standards (i.e. 20-40 entries).



Overall, ISO 19115 aims to define a comprehensive range of metadata elements that may be needed, so that any single application domain will normally select only a subset of the components available.

9 Review of GRDC collection criteria for discharge stations

In the 14 years of existence of the GRDC the collection criteria have widened due to the requirements of different clients. A strict categorisation of discharge stations remains difficult without exact knowledge of the local characteristics. E.g. at Environment Canada it took a large project to classify Canadian stations involving the hands-on experience of locally based employees handling the equipment on a day-to-day basis.

5th SC recommended that GRDC develop an information note on the collection criteria for GRDC stations. In Annex 11 of the Report of the 5th SC thus a draft entitled "Information note on GRDC station selection criteria, data format and data transfer" was presented. It is subdivide in 5 sections, namely:

I. Which information the GRDC is interested in?
II. Metadata
III. Guiding criteria
IV. Method of data transfer
V. GRDC's preferred data file format

SC was requested and invited to discuss the draft information note in subsequent meetings.

10 Review of GRDC data policy and data acquisition strategy

The current data policy, namely:

- Free and unrestricted (but identified) access to all hydrological data and products
- Data are free of charge (only costs of services and reproduction)
- No commercial use, commercial use may be subject to conditions
- Ownership of data and responsibility for errors lies at the data providers

- No redistribution of data by the user
- No distribution of the whole database (or substantial parts)

shall be discussed again.

Current practice is that a potential data user has to identified himself and his purpose and to agreed upon the data policy by signing a declaration (which can be send by fax). The data policy takes into account the considerable reluctance of data providers to let their data circulate freely (in spite of WMO-Resolution 25, Cg-XIII, 1999) and is determined by an international steering committee.
After identification, GRDC's basic data provision method is to disseminate the requested data non-bureaucratically as an email attachment or - if the requester does not provide an email address - by mailing floppy disks.

At the 5th SC the proposal was made by GRDC to flag all GRDC data to distinguish 3 classes of data:
- *Free access* (all that data which is already freely available anyway)
- *Free and unrestricted* (but identified) access (current practice)
- *No access to raw data* (only use for GRDC products allowed)

At 5th SC the view was expressed that the GRDC data policy cannot be more restrictive than Resolution 25. In particular the principle of free and unrestricted access to hydrological data supplied voluntarily by countries who are cognisant of Resolution 25 and the GRDC data policy would not be consistent with the idea to flag data as not being accessible. On the other hand for some parties it is difficult to understand why the access to their data that they already have published at *their* web-pages is aggravated again by the "identification-wattle" as a result of current GRDC policy guideline practice
The 5th SC decided to seek guidance in this critical matter from the AWG.

Regarding the priorities of where to concentrate GRDC's up-dating capacity 5th SC suggested to emphasis up-dating of the already existing project data sets of 251 stations on rivers close to the oceans and the almost 3000 stations featuring long time series', significant basin areas or very pristine conditions. In addition data sets such as for the ISLSCP-II initiative (see agenda item 8.1.1) or CEOP should be put high on the agenda regarding updating efforts.

5th SC advised GRDC to launch another formal acquisition campaign via the HWRD of WMO, i.e. preparing a letter together with a brief country report and sample products of the GRDC. Mr Grabs advised to do this in batches of e.g. 10 letters per time to not overuse the capacity of the secretariat at WMO-HWRD.

11 Quality assessment and quality control of GRDC data

4th SC has urged GRDC to define and implement a quality assurance program within the limitations defined by the availability of additional information. In the meantime GRDC has developed the so-called “Plausibility Tool”, which allows to comfortably check newly incoming data against the context defined by data already in the database.

4th SC discussed the need for an automated process for the real-time estimation of water level and discharge data. It was felt that such an automated process would be of great value to those collecting and processing hydrometric data, would greatly assist in improving the quality control (QC) and quality assurance (QA) activities, and would benefit the intended users of the data. Such a process was seen as being critical with the trend to real-time and near-real time systems such as advanced through WHYCOS. The SC recommended that an Expert Meeting be organised on the “Automation of QA/QC Procedures for Real-time Estimation of Water Level and Discharge Data”. Such a meeting fell under the joint auspices of the WMO and UNESCO. Both organisations were asked to consider their support for such an initiative. Mr Grabs said that this topic will be forward to the AWG in September.

5th SC was of the opinion that such a meeting is still desirable. 5th SC recommended to encourage Mr Pilon to take the lead - also in his role as Chairman of the CHy Working Group on Hydrological Forecasting and Prediction - in organising such a workshop and pursue the matter further.

WMO "Guide to hydrological practices" (WMO-No. 168) has contributions concerning data quality. The Guide provides guidance on current practices in operational hydrology and is the product of a collaborative effort of over 40 international experts in hydrology. It covers such subjects as instruments and methods of observation; collection, processing and dissemination of hydrological data; hydrological analysis; hydrological forecasting and applications of hydrological analysis for water management, all relevant with respect to QA/QC procedures.

Input from the Working Groups of the Commission for Hydrology, CHy (http://www.wmo.ch/web/homs/chy/chy.html).

- The Member responsible for CHy input to internal WMO activities of the CHy Advisory Working Group (http://www.wmo.ch/web/homs/chy/awg.html) K. Hofius (Germany) is -among other tasks- responsible to coordinate the collection, review and submission to CHy of material for the Technical Regulations and the Guide to Hydrological Practices, with an emphasis on groundwater and health and safety issues;
- The Expert on Data Management of the CHy Working Group on Water Resources (http://www.wmo.ch/web/homs/chy/wgwr.html) M. Kaneki (Japan) is - among other tasks - responsible to review and report on current data quality control procedures and update the Guide to Hydrological Practices accordingly;
- The Expert on Water Quality Alarm Systems of the CHy Working Group on Hydrological Forecasting and Prediction (http://www.wmo.ch/web/homs/chy/wghfp.html)
  Ms Coundrain-Ribstein (France) is - among other tasks - responsible to review material on Water Quality Alarm Systems within the Guide to Hydrological Practices and to prepare additional materials, as necessary, for inclusion in the Guide.

GRDC should closely collaborate with these experts.

12 Review of the Action Table resulting from the previous SC meeting

The action table shall be reviewed here.

Action table

resulting from the 5th Meeting of the GRDC Steering Committee Koblenz, 25–28 June 2001

Issue	**Ref. to item/ annex**	**SC decision/ recommendation**	**action by**
Vision statement	6 A.9	Vision statement was reaffirmed	
Strategic goals	6 A.9 14 and others	Strategic and implementation goals defined at the 4th SC meeting were reaffirmed in the scope of the priorities defined under item 16 and the discussions of the SC	GRDC
GRDC flyer	7.7.5	SC to consult GRDC by making suggestions for improvements	SC

WHYCOS	8.2.4	HYCOSes to forward their data to the GRDC	AWG
GTN-H	8.4	GRDC to contribute to GTN-H discharge component	GRDC
	8.4.8	GRDC to explore possibilities to bring together representatives of interested data providers	GRDC
FRIEND	8.5.1.7	GRDC to collaborate with individual FRIENDs and try to collaborate in data acquisition and metadata compilation	GRDC
HELP	8.5.2.4	GRDC to keep informed of the developments related to HELP	GRDC
WWAP	8.6.11	GRDC to liaise with WWAP in relevant aspects of information management	GRDC
GPCC	8.7.2.7	GRDC/GPCC to cross-validate GPCC and GRDC data	GRDC GPCC
Metadata and databases	10.1.9 14.6	GRDC not to work alone, but join forces together with others, most notably CHy AWG and CHy Working Group on Water Resources	GRDC J.Wellens-Mensah M. Kaneki
"	10.1.12 A.12	GRDC to... ...participate in working groups on metadata ...produce a link list to existing meta-databases ...produce a link list to relevant internet sites at river basin level ...collect the following meta-database entries ...consider general comments and recommendations related to the topic of metadata (see A.12)	GRDC AWG WG-WR and others
Evaporation data	10.2.3	WMO to write acquisition letters on evapotranspiration data to the individual members and forward the response to GRDC	WMO AWG
"	10.2.2	GRDC to offer rescued evapotranspiration data as static database-file on GRDC homepage	GRDC
GRDC station selection criteria	11.4	SC to discuss the draft information note in subsequent meetings	SC
Expert Meeting "Automation of QA/QC Procedures for Real-time Estimation of Water Level and Discharge	12, 12.2 14.8	P. Pilon to take the lead in organising the QA/QC workshop and pursue the matter further (in his role as Chairman of the CHy Working Group on Hydrological Forecasting and Prediction)	P. Pilon AWG

Data".	A.17		
Email correspondence with P. Pilon on QA/QC-meeting	12.4 12.3 A.17	SC to reflect on the ideas expressed in the correspondence.	SC
Data plausibility	12.8	GRDC to produce a technical note on its current practice regarding data plausibility checks	GRDC
Data acquisition	13	GRDC to develop a pragmatic concept aimed to improve contacts with data providers and possibly providing certain incentives for data providers to deliver more data in a timely fashion	GRDC
"	13.4	GRDC to address the Hydrological Advisors of the Permanent Representatives of a country to WMO and by carbon copy the Permanent Representative	GRDC
"	13.5	GRDC to distribute a short bulletin or newsletter to potential data providers.	GRDC
"	13.6	GRDC to ensure the feed back loop to demonstrate the gratitude towards the data providers	GRDC
"	13.8	GRDC to emphasis up-dating of already existing project data sets	GRDC
"	13.9	GRDC to launch a new formal acquisition campaign via the HWRD of WMO	GRDC
Role of GRDC	14.2	CHy to clarify the role of GRDC as compared to the role of WMO World Data Centres	AWG
GRDC contribution to major global projects	14.3	GRDC to publish its contributions, results achieved based on GRDC data on GRDC homepage	GRDC
GRDC marketing	14.4	GRDC to jointly market GRDC, GEMS/Water, GPCC and IGRAC programs	GRDC GEMS/Water GPCC IGRAC
Products Workshops	14.5	GRDC to plan and execute two Products Workshop: 1. GRDC to invite around 20 representatives of the technical level of NHSs 2. GRDC to invite experts from global research and assessment community	GRDC WMO
Address database of data providers and users	14.9	GRDC to publish the contacts on the GRDC web page	GRDC
Plan to distinguish 3 classes of GRDC	15.2.2	GRDC to seek guidance in this critical matter from the AWG (consistency with Resolution 25 vs. consistency	AWG

station data		with open data access practice of some members...)	
GRDC User Declaration	15.2.3	GRDC to create a facility to send a User Declaration electronically from the GRDC homepage	GRDC
GRDC priorities	16.2	GRDC to emphasis data acquisition (23%), product development (18%), database development (14%) and project involvement (9%), totalling 64% of its capacity	GRDC
3rd World Water Forum	16.3 A.13	GRDC to present itself at the 3rd World Water Forum in March 2003 in Japan	GRDC
Publications supported by GRDC data	16.3 A.13	GRDC to reference publications on scientific research supported by GRDC data should be listed on the GRDC homepage, if possible be linked	GRDC
Reference to recent data providers	16.3 A.13	GRDC to publish a list or map of recent data provisions to the GRDC	GRDC
Increasing GRDCs resources	16.4	GRDC to raise additional resources by outsourcing some of the tasks	GRDC
GRDC SC membership list	17.4 17.5	GRDC to delete WHO and the World Bank from, add WWAP and IGRAC to list	GRDC
"	17.6	GRDC to request guidance from the AWG regarding participating SC representative(s) of which developing country (countries) from which region(s)	AWG
"	17.8	GRDC to request SC membership approval by AWG	AWG

13 Future GRDC activities - discussion of long term strategic development, work plan and priority list

Based on the results of the discussion of the various agenda items, SC is requested for guidance in prioritising future GRDC activities in the light of the limited resources of GRDC.

Below the results of the polling procedure of the previous meeting is repeated:

1 data acquisition 23 %
2 product development 18 %
3 database development 14 %
4 project involvement 9 %
5 software development 9 %
6 public relation 7 %
7 visiting conferences 7 %
8 metadata developments 5 %
9 email communication 5 %
10 hosting of visitors 3 %

It was noted however that several classes are inter-linked, i.e. product development and involvement in projects.

In the view of the fact, that present staff of GRDC resembles the equivalent of approximately 4 full-time permanent staff whose funding is provided by the government of the Federal Republic of Germany through the Federal Institute of Hydrology and on the other hand, the increasing number and extent of tasks in which an involvement of GRDC seems to be desirable it is straightforward, that there are two principle possibilities to cope with this situation:

- adaptation of staff and funding for GRDC to that situation.
- concentration on priority tasks to not become a "Jack of all trades" at the cost of unsatisfying output.

SC is invited to discuss implications of the growing number of tasks and expectations on the physical development of GRDC and its work-plan priorities. An attempt should be made to estimate realistic timelines for the recommendations.

14 Review of membership of the Steering Committee

- Chairman: Mr K. Wilke
- Secretary to the SC: Head of GRDC http://grdc.bafg.de

- WMO http://www.wmo.ch/web/homs/
- UNESCO http://www.unesco.org/water/
- UNEP http://www.unep.org/dewa/water/
- ICSU/IAHS http://www.cig.ensmp.fr/~iahs/
- BfG http://www.bafg.de/
- GPCC http://www.dwd.de/research/gpcc
- GWCC http://www.cciw.ca/gems/
- IGRAC
- FRIEND http://www.nwl.ac.uk/ih/www/research/bfriend.html
- WCRP http://www.wmo.ch/web/wcrp/
- WWAP http://www.unesco.org/water/wwap/
- CHy http://www.wmo.ch/web/homs/chy/chy.html
- Government of Japan http://www.mlit.go.jp/river/english/
- Representative of developing countries from WMO regions not represented at the meeting

15 Date and venue of next meeting

SC may consider the date of the next meeting in June 2005. Having had the SC meeting for the sixth time in Koblenz, SC is invited to think of feasible alternatives for the 7th meeting of GRDC-SC.

16 Closure of meeting

Annex 3 Membership of the Steering Committee by organisations or group

Membership of the Steering Committee by organisation or group

6th GRDC Steering Committee Meeting,
11 – 13 June 2003, Koblenz, Germany

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Members:

WMO	World Meteorological Organization
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
ICSU/IAHS	International Council of Scientific Unions/ International Association of Hydrological Sciences
GPCC	Global Precipitation Climatology Centre
GEMS/Water	Global Environmental Monitoring System / Freshwater Quality Programme
IGRAC	International Groundwater Resources Assessment Centre
FRIEND	Flow Regimes from International Experimental and Network Data
WCRP	World Climate Research Programme
CHy	Commission for Hydrology
Government of Japan	Government of Japan
Representative from Developing Country	Developing Countries in Africa, Asia, South America
BfG	Bundesanstalt für Gewässerkunde (Federal Institute of Hydrology)

Observers:

German IHP/OHP Secret.	German Secretariat of the International Hydrological Programme of UNESCO (IHP) and of the (former) Operational Hydrological Programme of WMO (OHP)
WWAP	World Water Assessment Programme
Former Chairman	Prof. H.-J. Liebscher

Annex 4 List of attendees

List of attendees

6th GRDC Steering Committee Meeting,
11– 13 June 2003, Koblenz, Germany

in alphabetic order:

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Annex 6 Extracts from WMO Congress XIX, agenda item 3.5

Annex 6

Extracts from the Abridged Final Report on WMO Congress XIV (5–24 May 2003): Most GRDC-relevant passages from agenda item 3.5, Hydrology and Water Resources Programme (HWRP)

Concerning the new Subtitle of the Organization:

3.5.0.16 Congress recalled that at its last session, while it had noted the increased involvement of WMO in the resolution of global water issues, it had felt that there was still a need to enhance further the role and visibility of the Organization in hydrology and water resources. In that connection, Congress had seen merit in reflecting hydrology in a subtitle of the Organization and had requested the Executive Council to study further that matter and to report back to Fourteenth Congress. Accordingly, the fifty-third session of the Executive Council had requested the president of CHy to bring to the fifty-fourth session of the Executive Council a specific proposal for a subtitle of WMO which would reflect adequately the Organization's responsibilities in hydrology and water resources.

3.5.0.17 The president of CHy reported to Congress that he had submitted to the fifty-fourth session of the Executive Council three alternatives for the wording of the subtitle for WMO, that were proposed by the CHy Advisory Working Group. The Council had agreed that the words **"weather, climate and water"** would best reflect the main areas of work of the Organization. Accordingly, the fifty-fourth session of the Executive Council had recommended to Fourteenth Congress that the subtitle be "weather, climate and water". The CHy AWG, at its last session, fully supported the recommendation made by the fifty-fourth session of the Executive Council. Furthermore, the Council had requested the Secretary-General to provide guidance to Fourteenth Congress on how the status of the subtitle and on how and when it could be used, and also on how well the subtitle translated into other languages. The resulting documents were considered under agenda item 5.

5.18 Congress recalled that Thirteenth Congress had considered the question as to whether it would be appropriate that the name of the Organization be amended to reflect better its responsibilities in the field of hydrology, and that while not favouring a change of name, saw merit in reflecting hydrology in a subtitle. Consequently, it requested the Executive Council to study further that matter and to report back to Fourteenth Congress.

5.19 Congress noted that the Executive Council, at its fifty-fourth session, after reviewing several proposals submitted by the president of CHy, recommended that the **subtitle** be **"weather, climate and water"**.

5.20 Congress was informed that there were no major inconveniences in translating the proposed subtitle in the different WMO official languages. As regard the status of the subtitle and how and when it could be used, Congress agreed that it could be used as a "motto" on all official documentation, correspondence and publications.

5.21 In view of the above, Congress adopted Resolution 24 (Cg-XIV).

Concerning the Water Resources Assessment Handbook

3.5.1.1 Congress noted with appreciation the Secretariat's efforts in promoting the use of the WMO/UNESCO Water Resources Assessment — Handbook for the Review of National Capabilities. In that connection, Congress was pleased to learn of the organization of a series

of subregional training workshops to promote the application of the methodology described in the Handbook in different regions. It was also pleased to note that the Handbook was now available in English, French, Russian and Spanish, in printed and pdf format freely downloadable from the WMO or UNESCO Web sites.

3.5.1.2 Congress was informed that CHy was considering the preparation of a user-friendly manual to assist countries in assessing their water resources. It supported the idea and encouraged CHy and the Secretariat to pursue that matter further.

3.5.1.3 Congress noted with interest the efforts being undertaken by the Secretariat and CHy stemming from the decision of the eleventh session of CHy to focus attention on obtaining concrete deliverables through projects, two of which were associated with advanced basic systems. The first was directed to **increasing the ability of Members to acquire real-time quality-controlled estimates of water levels and discharges** using advanced technologies, while the second was directed to the **identification of metadata for hydrological data**, including mechanisms for the provision, display and access to the metadata.

Concerning the Guidance and regulatory material

3.5.1.4 Congress was informed that the fifth edition of the **Guide to Hydrological Practices** (WMO-No. 168) had been translated or was in the process of being translated into national languages by some Members, notably Germany, Hungary, Italy and Turkey. It also noted with appreciation that China had offered to assist the WMO Secretariat in translating the Guide into Chinese. Congress was also pleased to note that a CD-ROM containing the English and French versions had been issued in September 2001 and that the preparation of the Russian and Spanish version in electronic format was under way.

3.5.1.5 Congress noted that the eleventh session of CHy had agreed on the preparation of a sixth edition of the Guide and had recommended that it should be given highest priority. **Congress strongly recommended that the sixth and future editions of the Guide should be made available both for free downloading from the Internet and on CD-ROM** to be distributed free of charge to Members.

3.5.1.6 Congress noted that at the request of the eleventh session of CHy, the AWG was undertaking the review of the WMO Technical Regulations (WMO-No. 49), Volume III — Hydrology and their annexes. It recognized the need for a better balance between regulations addressing water quantity and those addressing water quality also in view of improving the compatibility between the Guide and the Technical Regulations.

3.5.1.7 Congress noted the results of a survey that had been carried out by the Secretariat to assess the use and benefits of the Technical Regulations to the NMHSs.

Concerning the Hydrological Information Referral Service (INFOHYDRO)

3.5.1.8 Congress was informed that CHy was undertaking a **review and revision** of the contents and scope of INFOHYDRO, with the objective of retaining most of the valuable information contained in previous editions, while at the same time **making it easier for Members and the Secretariat to update the information using metadatabase standards** and recommended structures to enable consistent reporting of information. Congress noted that a draft revised version of INFOHYDRO had been prepared and was currently being tested by the vice-president of CHy in RA V and that it would be available for the twelfth session of CHy in 2004.

Concerning the Hydrological Operational Multipurpose System (HOMS)

3.5.1.9 Congress noted the satisfactory advance in the implementation of the Plan for HOMS in the twenty-first century, the main objective of which had been to revitalize that valuable vehicle for the transfer of hydrological technology by clearly setting the guidelines for the further development and update HOMS. It was pleased to learn that 122 HOMS National Reference Centres and eight Regional HOMS Reference Centres were currently active.

3.5.1.10 Congress also noted that **since 2000 the HOMS Reference Manual was available online**, and that in 2001 a CD-ROM version of it, together with promotional material on HOMS were distributed to all the HOMS National Reference Centres. The online version of the Manual was updated regularly, and appeared to be consulted and utilized with ever increasing frequency by hydrologists world wide, especially since the components descriptions had become available in English, Spanish, French and Russian.

3.5.1.11 Congress learned with interest of several training activities related to HOMS initiated in 2002 and recommended that greater emphasis be placed in the next financial period in that aspect of technology transfer. The concept of roving seminars on HOMS components of relevance to different regions was found of particular use, in view of their cost-effectiveness and multiplier effects. Congress expressed its appreciation for Canada's support to the training of instructors from RA I on Canadian HOMS components and invited other Members to provide similar support for such activities.

Concerning the World Hydrological Cycle Observing System (WHYCOS)

3.5.1.12 Congress was pleased to note that WMO had continued its efforts in promoting the development and implementation of the WHYCOS programme in all WMO's Regions. It was informed that WHYCOS continued to generate interest in hydrological communities around the world. It noted that WHYCOS had been especially active on the African continent, where MED-HYCOS, SADCHYCOS phase I and a Pilot Phase for Western and Central Africa (AOC-HYCOS) had actually been implemented, while the preparation of detailed implementation of IGAD-HYCOS was taking place. Keeping in view the past and future developments in WHYCOS projects, Congress recommended to keep in force Resolution 20 (Cg-XII) on WHYCOS.

3.5.1.13 Congress was pleased to note that in March 2003, the Third World Water Forum in Kyoto, Japan recommended strengthening the capacity of small island countries to conduct water resource assessment and monitoring, inter alia, using the model outlined in the Pacific and Caribbean HYCOS proposals.

3.5.1.14 Congress was pleased to also note that several HYCOS projects had reached advanced stages of development, including the preparation of detailed project documents and/or the development of official contacts and meetings with major stakeholders of the projects. Such was the case in the Caribbean Islands (CARIB-HYCOS), the South-West Pacific region (Pacific-HYCOS), the Hindu Kush Himalayan Region (HKH-HYCOS), the riparian countries of the Baltic Sea (Baltic-HYCOS), Aral Sea (Aral-HYCOS) and of the MEKONG-HYCOS. Other proposals under consideration addressed the basins of Amazon, Congo, Danube and La Plata rivers as well as the Black Sea.

3.5.1.15 Congress expressed its appreciation for the financial support provided to different HYCOS projects by international and bilateral donors (the World Bank, the European Commission, the Government of France, the Government of The Netherlands, among others). It also noted that most HYCOS components had been implemented in developing countries,

contributing substantially to the support of data collection, data exchange and capacity-building activities of the participating NHSs.

3.5.1.16 Congress was informed that so far there were no donors for funding a full-scale HYCOS component for Western and Central Africa. WMO planned to implement WHYCOS in the region through a number of large transboundary river basin components, in association with the existing intergovernmental river basins authorities. At the request of the relevant river basin authorities and Members, WMO had prepared project documents for NIGER-HYCOS (Niger River Basin) and Volta-HYCOS (Volta River basin). Congress asked the Secretary-General to ensure that additional proposals for the Lake-Chad basin and the Senegal River basin be developed in the near future.

3.5.1.17 Congress realized that efforts should be made to secure extrabudgetary sources of funding for HYCOS projects. It stressed the need to ensure the continuity of the programme when external assistance would cease. Congress recognized also the need for close coordination among the individual HYCOS components. In that regard, it noted with satisfaction the role of the coordination mechanism for WHYCOS within the WMO Secretariat and of the WHYCOS International Advisory Group in guiding the development of the overall programme. The WHYCOS International Advisory Group had met regularly once a year, its fifth meeting having been held in January 2003. Congress noted with particular interest that preparation of guidelines on WHYCOS was advancing well under the coordination of the WHYCOS International Advisory Group.

3.5.1.18 In accordance with the development objectives set by the WSSD and the high priority of the water agenda for the coming decades, Congress urged donors and other funding agencies to coordinate and increase their efforts in supporting the implementation of regional water resources information systems, which was the overall objective of the HYCOS projects.

3.5.1.19 Congress noted that data exchange at the regional level, and more specifically within the limits of large transboundary river basins or aquifers, was not only a crucial prerequisite for a sound development — allowing the equitable and reasonable share of the water resources and the protection of the environment — but also an important process preventing disputes between riparian countries sharing those resources. Congress strongly recommended the exchange of hydrological data and products in the framework of existing and future HYCOS projects, in accordance with WMO Resolutions 20 (Cg-XII) and 25 (Cg-XIII). The hydrological data and products generated by HYCOS projects should not only be available to the participating NHSs, but should benefit all economic and social stakeholders concerned with waterrelated issues, including the general public.

3.5.1.20 Congress expressed its appreciation for the development of WHYCOS through the various HYCOS components and recommended that efforts be substantially intensified so as to ensure a rapid and successful implementation of such projects. **Congress requested the Secretary-General to prepare a comprehensive report on the status of HYCOS projects under way and to assess their state of implementation and sustainability**.

Concerning the Global Terrestrial Network for Hydrology (GTN-H):

3.5.2.14 Congress was advised on the establishment of GTN-H in 2001 as a response to the need for improved global hydrological data, information and products to research and assess environmental change, identify significant trends and develop adequate response strategies.

3.5.2.15 Congress was informed of the **implementation plan developed for GTN-H**. The plan outlined common practices among the participating programmes and centres, the

procedures for harmonizing the products among the participants and the processes to be used for data dissemination. An integrated data management strategy (data collection, archiving, dissemination through the GTN-H network) was also considered together with the core functions of GTN-H. 3.5.2.16 Congress noted with interest that GTN-H was formally established creating a "network of networks" of global data centres and information providers for hydrological and relevant meteorological data and information. Congress further noted the efforts through **GTN-H to establish a reference hydrometric network that would serve to understand better climate change impacts on hydrological regimes**. Congress noted with satisfaction that GTN-H encouraged the free exchange of data within existing policy frameworks, including Resolutions 40 (Cg-XII) and 25 (Cg-XIII).

3.5.2.17 Congress noted with appreciation that the first meeting of the coordination group for GTN-H had been held in Toronto from 21 to 22 November 2002 following an expert meeting on Hydrological Data for Global Studies held at the same location from 18 to 20 November 2002. Both meetings were organized by WMO in collaboration with GCOS and were hosted by the Meteorological Service of Canada.

3.5.2.18 Congress was advised that the expert meeting had provided comprehensive information on current and emerging observational requirements and the availability of hydrological data for global studies including issues related to data standardization, data management and the multidimensional integration of databases.

3.5.2.19 Congress expressed its gratitude to the Meteorological Service of Canada for providing secretarial and coordination services for GTN-H and called for active support of collaborating centers in the generation of products through GTN-H.

Concerning the Global Runoff Data Centre (GRDC):

3.5.2.20 Congress noted with appreciation that the GRDC had continued to be recognized as an important source of data on river flow. Congress recalled that the need for data and information on the availability and use of fresh water was identified by the United Nations General Assembly at its special session in June 1997 and discussions on the role of GRDC saw that as an important pointer to the future.

3.5.2.21 Congress noted with the interest the ongoing activities by GRDC and collaborating partners to **identify a network of hydrological stations worldwide** from which data could be accessed in **near real-time and regularly** through the Internet and encouraged GRDC to strive to release a prototype version as early as possible.

3.5.2.22 Congress urged GRDC to continue production of scientific reports on global hydrological issues and to strengthen its efforts to obtain data from Members more timely.

3.5.2.23 Congress noted with concern that, in many cases, the transfer of hydrological data from Members to the GRDC had taken several years and **urged Members to make discharge data available to GRDC in an institutionalized and timely manner**.

3.5.2.24 Recognizing the importance of the services provided by GRDC, Congress decided to **keep in force Resolution 21 (Cg-XII)**.

Annex 7 Proposal for river discharge metadata provided by Mr Kinosita

Meta Data on Runoff Data Base

Dr. Takeo Kinosita
Suimon Kankyo

The followings are examples of proposed meta data on the runoff data base in Japan, but not yet decided today.

Name of observation station
River system and tributary
Name of the city or the town (location)
Longitude and latitude (Location of the sensor)
Elevation of the zero point of the gauge
Drainage area
Distance from the river mouth or the confluence
Location map

Duration of observation for daily discharge
Topography (delta, alluvial plain, etc.)
Water gauging system (staff gauge, recording gauge, etc.)
Observation procedure (moving boat, current meter, drift rod,etc.)
Rating curve (stage-discharge relation)
Tidal influence.
Diversion upstream (navigation canal, agriculture, etc.)
Reservoir upstream (capacity, water release rule, etc.)
Water release from hydropower

Statistics

- Maximum, Minimus
  - in the year
  - in the part
  - in the past 30 years
- Flow regime
- Specific discharge

Procedure of data check

- Algorithm
- Judgment

Annex 8 Information note on river discharge quality assurance provided by Mr Kinosita

Quality Assurance in Precipitation and Discharge

Dr. Takeo Kinosita
Suimon Kankyo

1. Introduction

Quality must be assured whenever and wherever observation is carried out. Precipitation and discharge are observed by the River Bureau of the Ministry of Land. Infrastructure and Transport in Japan. It has organized the Committee for Hydrological Observation. The author is a member of the Committee to contribute to improve the observation systems.

Quality assurance activity has two aspects. One is to assure the data quality at the gauging site. Another is to check the data quality in the data base. Both are closely related each other. The author will explain what kind of problems were found and how to solve them.

2. Field Survey

The author has carried out field survery as quality assurance at the gauging sites. Several problems were found at that time. The followings are some examples.

(1) Flood discharge must be observed at the full range of water level, up to design flood water level. Observation at or higher than the high water level is difficult. Preparation is required at normal stage for high water observation.

(2) Observation facility must be repaired if it is broken. Safety networks must be completed at the ganging site.

(3) There are many sites where a drift rod cannot be seen during the observation period, because of thick bushes and shrubs.

(4) Automatic recording gauge must be calibrated before installation. Calibration certificate must be seen by everyone.

(5) Flow on the flood plain must be properly measured ever if the flow velocity on the plain is slow.

(6) Reference staff gauge must not be attached to the bridge pier. Because a shock wave appears when a flow velocity is rapid due to a flood.

(7) Double gauge system is preferable. But how can we replace the gauge1 by the gauge2 when the data of the gauge1 are gradually separating from those of the gauge2.

(8) Low-water flow cannot be easily measured in a tidal reach. An adequate procedure must be invented.

(9) he bench mark must be installed at clear place near the water gauge. The staff gauge must be set at the base line. The zero point of the staff gauge must be levelled from the bench mark. The observed value by the recording gauge must coincide with the staff gauge.

(10) The currentmeter site must be properly selected. The currentmeter must be calibrated once a year.

3. Check of Data in Data Base

River Bureau has about 2500 rain gauge stations and about 2500 water gauge stations. It is planned to check the data in the data base every half a year, as routine works.

3.1 Precipitation

(1) Standard Deviation

At every station and every month, maximum hourly precipitation in the past is selected from the data base. Then the average m and the standard deviation s are calculated. At the same station and in the same month, the data exceeding m+ns might be anomalous, where n is temporarily 3.

The same procedure can be applied to the daily precipitation.

(2) Correlation

The time series of precipitation at some station can be compared with those at adjacent stations by making the correlation coefficient. If it is less than 0.8 (temporary), there must be an anomalous relation between them.

(3) Total Precipitation

The precipitations at three adjacent stations at a certain period form a precipitation plane. The precipitation at the same period at the check station must be close to the precipitation plane. If not, precipitation at the check station is anomalous.

3.2 Water Stage

(1) Correlation

The time series of water stages at the upstream station and the downstream station must be correlated. In this procedure, the lag time must be introduced to find the maximum correlation.

(2) Constant Water Stage

When the water stage is constant for the considerable period at some station, the water stage is anomalous. The recorder or other equipment may be out of order.

(3) Sudden Rise of Water Stage

If the water stage suddenly rises, rainfall or water release from a reservoir must be

investigated. If the reason of sudden rise is not clear, the water stage must be anomalous.

(4) Sudden Fall of Water Stage

If the water stage suddenly falls, an anomalous event might occur. The water stage must generally go down like an exponential curve.

(5) Peak Water Stage

The peak of water stage can be found in the time series of the water stages at several gauging stations. Check whether the peak occurs successively from upstream to downstream.

3.3 Observed Discharge

(1) Peak Discharge

The peak of observed discharge can be found in the time series of the observed discharge at the several gauging stations. Check whether the peak occurs successively from upstream to downstream.

(2) Rating Curve

A rating curve, called an H-Q curve in Japan, is drawn by the least square method as $Q=a(H+b)^2$, where H is the water stage on the ordinate, Q is the discharge on the abscissa, a and b are empirical constants. When the H-Q curve makes a clockwise loop, some event, for instance a tide, is coming upstream. When it makes a counterclockwise loop, it means a flood. If not, careful inspection should be given to basic data, especially the stage velocity relation.

When the rating curve makes a counterclockwise loop in the flood period, the surface gradient is useful to adjust the curve to a single-valued function. The adjusted discharge is written by $Qa=Qo\ SQRT\ (Ia/Io)$ where Qo and Io are observed discharge and surface gradient and Ia is an average gradient. The surface gradient must be calculated at two gauging sites separated each other several kilometer.

A steady flow H-Q curve is proposed to check the observed H-Q curve and to extrapolate the curve slightly. Two parameters in a H-Q curve, a and b, are determined by

$$a=v\ (1+p)^2*B^2/4A \qquad b=2R/(1+p)-H$$

where v is the mean velocity, p is the power of steady flow formula, B is the river width, A is the cross section, R is the hydraulic radius and they are all observed values.

4 Conclusion

Through the field survey and check of data in data base, many significant problems were found. They are classified into two, common problems and local problems.

The former will be solved by research organizations while the latter will be managed by local offices. In the case of data check, it is very hard to change the value when it is found to be anomalous. We mostly do not change the value. But an anomalous value leads us to improve the observation system. Thus next time when we make observation, the observed value might be corrected. Step by step, hydrological data will be assured.

References

KINOSITA, Takeo, SHIMIZU,Y., NAKAO,T. : Improvement of Quality in Hydrological Data (in Japanese) Advances in River Engineering, Vol.9 Japan Society of Civ, Eng. June 2003.

KINOSITA, Takeo : Quality Assurance in Hydrological Data, IUGG-IAHS General Assembly, Workshop Abstract "Quality Assurance in Hydrological Research" July 2003.

Annex 9 List of contents of CD-ROM attached to this report

Annex 9

Contents of the digital annex to the Report of the 6th Meeting of the GRDC Steering Committee, 11 -13 June 2003, Koblenz, Germany as available from attached CD-ROM or alternatively from ftp://www.bafg.de/pub/REFERATE/GRDC/GRDC_SC_6 (see also http://grdc.bafg.de/?2306)

All files are available compressed in one archive:	file size [in byte]
GRDC SC 6 annex V1.zip doc	62,900,000

or can alternatively be retrieved by file according to the following list:

		file size [in byte]
GRDC SC 6 Ag 1	participants.doc	36,352
GRDC SC 6 Ag 2	Agenda_10_June.xls	26,112
GRDC SC 6 Ag 2	Annotated Agenda_10_June.doc	350,208
GRDC SC 6 Ag 3	Address by the Director of the Federal Institute of Hydrology_Volkhard Wetzel.doc	24,576
GRDC SC 6 Ag 3	Funds_GRDC_2003.ppt	53,760
GRDC SC 6 Ag 4.3	Data dissemination and GRDC Database Usage_Thomas Luellwitz.pps	130,560
GRDC SC 6 Ag 4.4	Developments of the database management system_Johannes Pauler.doc	410,624
GRDC SC 6 Ag 4.4	Developments of the database management system_Johannes Pauler.ppt	209,920
GRDC SC 6 Ag 4.5.1	Mean Annual Freshwater Surface Water Fluxes into the World Oceans_Thomas de Couet.ppt	2,982,400
GRDC SC 6 Ag 5	WMO and CHy WG activities relevant to the work of the GRDC_Wolfgang Grabs.ppt	58,368
GRDC SC 6 Ag 6.1	WCRP-GEWEX+CliC_Vladimir Ryabinin.ppt	10,578,944
GRDC SC 6 Ag 6.5.1	FRIEND_Gwyn Rees.ppt	3,683,840
GRDC SC 6 Ag 6.5.2	HELP_Camille Talayssat.ppt	15,269,888
GRDC SC 6 Ag 6.6	Advisory Group for WWAP Information Network_Takeo Jimbow.ppt	37,376
GRDC SC 6 Ag 6.6	WWAP-Global_Water_Metadata_schema_Takeo Jimbow.pdf	12,123,648
GRDC SC 6 Ag 6.6	WWAP_Takeo Jimbow.ppt	45,775
GRDC SC 6 Ag 6.8.1	GEMS-GRDC2003_Andy Fraser.ppt	12,576,256
GRDC SC 6 Ag 6.8.2	GPCC_to_GRDC-20030612_Bruno Rudolf.ppt	2,949,632
GRDC SC 6 Ag 6.8.3	IGRAC_General Presentation_12 June 2003_Jac van der Gun.ppt	2,500,608
GRDC SC 6 Ag 7.2	EFFS (European Flood Forecasting System)_Thomas Maurer.ppt	1,191,424
GRDC SC 6 Ag 7.3	Globwinet_at_GRDC'_Ruger Winnegge.PPT	1,491,456
GRDC SC 6 Ag 8	GRDC_data_integration+metadata_Thomas Maurer.ppt	540,160
GRDC SC 6 Ag 9	GRDC_selection_criteria_format.pdf	119,984
GRDC SC 6 Ag 10	Policy guidelines for the dissemination of data.pdf	116,381
GRDC SC 6 Ag 11	Quality assessment and quality control of GRDC data.doc	410,624
GRDC SC 6 Ag 11	Quality assessment and quality control of GRDC data_Johannes Pauler.ppt	278,528
GRDC SC 6 Ag 12	Action table 2001.doc	72,192
Picture 1 of GRDC SC meeting participants, Koblenz, Germany, 11-13 June 2003.jpg		1,486,089
Picture 2 of GRDC SC meeting participants, Koblenz, Germany, 11-13 June 2003.jpg		1,486,592

Annex 10 List of acronyms and associated URLs

Annex 10 List of acronyms and associated URLs

(see also http://grdc.bafg.de/?3225)

2AR	Second Report on the Adequacy of the Global Observing Systems for Climate	http://www.wmo.int/web/gcos/gcoshome.html
AARI	Arctic and Antarctic Research Institute	http://www.aari.nw.ru
ACSYS	Arctic Climate System Study (WMO - WCRP)	http://acsys.npolar.no
ADIS	ACSYS Data and Information Service	http://acsys.npolar.no/adis/adis.php
ANZLIC	Spatial Information Council of the Australian Government, the New Zealand Government and the governments of the States and Territories of Australia	http://www.anzlic.org.au
AOC-HYCOS	Système d'Observation du Cycle Hydrologique de l'Afrique de l'Ouest et Centrale	http://aochycos.ird.ne/INDEX/INDEX.HTM
AOPC	Atmospheric Observation Panel for Climate of GCOS	http://www.wmo.int/web/gcos/aopc.htm
APFM	Associated Programme on Flood Management	http://www.apfm.info
ARDB	Arctic Runoff Data Base	http://ardb.bafg.de
AWG	CHy Advisory Working Group	http://www.wmo.int/web/homs/chy/awg.html
BALTEX	Baltic Sea Experiment	http://dvsun3.gkss.de/baltex
BfG	Bundesanstalt für Gewässerkunde, Federal Institute of Hydrology	http://www.bafg.de
BGR	Federal Institute for Geosciences and Natural Resources, Germany	http://www.bgr.de
BMVBW	Bundesministerium für Verkehr, Bau- und Wohnungswesen, Fed. Min. for Transport, Building & Housing	http://www.bmvbw.de
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung, Fed. Min. for Economic Cooperation and Development	http://www.bmz.de/en
Cap-Net	International Network for Capacity Building in Integrated Water Resources Management	http://www.cap-net.org
CATCH	Coupling of the Tropical Atmosphere and Hydrological Cycle	http://www.lthe.hmg.inpg.fr/WEB_Catch/Accueil_CATCH_en.html
CBS	WMO's Commission For Basic Systems	http://www.wmo.int/web/www/BAS/CBS-info.html
CEB	Chief Executives Board of UN	http://ceb.unsystem.org
CEH	Centre for Ecology and Hydrology	http://www.ceh.ac.uk
CEOP	Coordinated Enhanced Observing Period	http://www.ceop.net , http://monsoon.t.u-tokyo.ac.jp/ceop
CEOS	Committee on Earth Observation Satellites	http://www.ceos.org
CESR	Center for Environmental Systems Research	http://www.usf.uni-kassel.de/usf
Cg	WMO Congress	http://www.wmo.int
Chy	WMO's Commission for Hydrology	http://www.wmo.int/web/homs/chy.html
CliC	Climate and Cryosphere Programme (WMO - WCRP)	http://clic.npolar.no
CLIVAR	Climate Variability and Predictability	http://www.clivar.org
CMS	Content Management System	
CODATA	ICSU Committee on Data for Science and Technology	http://www.codata.org
COP	Conference of the Parties, e.g. of UNFCCC	
CORDIS	Community Research & Development Information Service of EU	http://www.cordis.lu
CRU	Climatic Research Unit	http://www.cru.uea.ac.uk
CSD	UN Commission on Sustainable Development	http://www.iisd.ca/linkages/csd, http://www.un.org/esa/sustdev
CSDGM	Content Standard for Digital Geospatial Metadata of FGDC	http://www.fgdc.gov/metadata/csdgm
CSE	GEWEX Continental Scale Experiments	
CSRC	Complex Systems Research Center (at UNH)	http://www.csrc.sr.unh.edu

CUAHSI	US Consortium of Universities for Advancement of Hydrologic Science, Inc.	http://www.cuahsi.org
DAAC	ORNL Distributed Active Archive Center	http://daac.ornl.gov
DFO	Dartmouth Flood Observatory	http://www.dartmouth.edu/~floods
DCMI	Dublin Core Metadata Initiative	http://dublincore.org
DCP	Data Collection Platform	
DCW	ESRI's Digital Chart of the World	http://www.maproom.psu.edu/dcw
DDM30	0.5 degree Drainage Direction Map of CESR	
DEWA	UNEP Division of Early Warning and Assessment	http://www.unep.org/dewa
DGER	Database for Global Environmental Research	http://www-cger.nies.go.jp/cger-e/db/info-e/InfoDBWeb/index.htm
DGIWG	Digital Geographic Information Working Group	http://metadata.dgiwg.org
DISC	Data and Information Service for CliC (DISC)	http://clic.npolar.no/disc/disc.php
DIVERSITAS	Int. Programme on Biodiversity Science	http://www.diversitas-international.org
DKRZ	Deutsches Klimarechenzentrum	http://www.dkrz.de
DLR	Deutsches Luft- und Raumfahrt Zentrum	http://www.dlr.de
DMIP	Data Management and Information Panel	http://ipo.npolar.no/org/dmip.php
DMS	Document Management System	
DMWG	GHPs Data Management Working Group (GEWEX)	http://www.joss.ucar.edu/ghp
DODS	Distributed Oceanographic Data System	http://www.unidata.ucar.edu/packages/dods
DSS	SCD's Data Support Section	http://dss.ucar.edu
DWC	Dialogue on Water and Climate	http://www.wac.ihe.nl
DWD	Deutscher Wetterdienst (German Weather Service)	http://www.dwd.de
DWFE	Dialogue on Water, Food and Environment	http://www.iwmi.cgiar.org/dialogue
Earthwatch	United Nations (UN) System-Wide Earthwatch	http://earthwatch.unep.net
EC	European Commission	http://europa.eu.int/comm/index_en.htm
EC of WMO	Executive Council of WMO (e.g. LIII i.e. 53rd session)	http://www.wmo.int
EC-AGE	Executive Council Advisory Group on the International Exchange of Data and Products	http://www.wmo.int/web/pla
ECMWF	European Centre for Medium-Range Weather Forecasts	http://www.ecmwf.int
ECPC	Experimental Climate Prediction Center	http://ecpc.ucsd.edu
EEA	European Environmental Agency	http://www.eea.eu.int
EFAS	European Flood Alert System	http://ies.jrc.cec.eu.int/European_Flood_Alert_System.98.0.html
EFFS	European Flood Forecasting System	http://effs.wldelft.nl
EIONET	European Environment Information and Observation Network of EEA	http://www.eionet.eu.int
EMWIS	Euro-Mediterranean Information System on the know-how in the Water sector	http://www.emwis.org
EOS	arth Observation Summit	http://www.earthobservationsummit.gov
ERN	European Rivers Network	http://www.rivernet.org/ern.htm
EROS Data Center	USGS's Earth Resources Observation Systems Data Center	http://edcwww.cr.usgs.gov
ESA	European Space Agency	http://www.esa.int
ESRI	Environmental Systems Research Institute, Inc.	http://www.esri.com
ESSP	Earth System Science Partnership	http://www.ess-p.org
ESTEC	European Space Research and Technology Centre	http://www.estec.esa.nl
ET-IDM	Expert Team on Integrated Data Management of CBS of WMO	http://www.wmo.int/web/www/CBS-Reports/ISS-index.html#WDM
ETOPO2	2 Min Gridded Earth Topography Data by NGDC	http://www.ngdc.noaa.gov/mgg/image/2minrelief.html
ETOPO5	5 Min Gridded Earth Topography Data by NGDC	http://www.ngdc.noaa.gov/mgg/global/etopo5.HTML
EU	European Union	http://europa.eu.int

EurAqua	Network of European Freshwater Organizations	http://www.euraqua.org
EWA	European Water Archive of FRIEND-NE	http://ewa.bafg.de
EWFD	European Water Framework Directive	http://europa.eu.int/comm/environment/water
FAO	Food and Agriculture Organization	http://www.fao.org
FGDC	Federal Geographic Data Committee	http://www.fgdc.gov
FGGE	First GARP Global Experiment	http://www.meteo.ru/fund/pgepe1.htm
FIGCC	FRIEND Inter-Group Coordination Committee (see also FRIEND)	
FRICS	Foundation Of River & Basin Integrated Communications	http://www.river.or.jp, in Japanese
FRIEND	Flow Regimes from International Experimental and Network Data	http://www.nwl.ac.uk/ih/www/research/bfriend.html
FRIEND HKH	FRIEND Hindu Kush-Himalayan	http://www.nwl.ac.uk/ih/www/research/bfhkh.html
FRIEND-AMHY	FRIEND Alpine and Mediterranean Hydrology	http://armspark.msem.univ-montp2.fr/amhy
FRIEND-NE	Northern European FRIEND	http://ne-friend.bafg.de
FWIS	Framework for the WMO Information System of CBS	
G3OS	The Three Global Observing Systems (GCOS, GOOS and GTOS)	http://earthwatch.unep.net/data/g3os.php
GAME	GEWEX Asian Monsoon Experiment	http://www.ihas.nagoya-u.ac.jp/game
GAME-HUBEX	GAME-Huaihe River Basin Experiment	http://www.ihas.nagoya-u.ac.jp/game/hubex/www.hubex.pku.edu.cn
GAME-Sibiria	GAME-Sibiria	http://www.ihas.nagoya-u.ac.jp/game/GAME-Siberia.html
GAME-Tibet	GAME-Tibet	http://www.ihas.nagoya-u.ac.jp/game/GAME-Tibet.html
GAME-Tropics	GAME-Tropics	http://hydro.iis.u-tokyo.ac.jp/GAME-T
GAPP	GEWEX American Prediction Project	http://www.ogp.noaa.gov/mpe/gapp
GARP	Global Atmospheric Research Programme	http://www.cgd.ucar.edu/cas/tn404/text/tn404_11.html
GAW	Global Atmosphere Watch of WMO	http://www.wmo.ch/web/arep/gaw/gaw_home.html
GCDIS	Global Change Data and Information System	http://globalchange.gov
GCIP	GEWEX Continental-Scale International Project	http://www.ogp.noaa.gov/mpe/gapp/gcip
GCMD	Global Change Master Directory	http://gcmd.nasa.gov
GCOS	Global Climate Observing System	http://www.wmo.int/web/gcos/gcoshome.html
GDS	GrADS-DODS Server	http://grads.iges.org/grads/gds
GEF	Global Environment Facility	http://www.gefweb.org
GEIN	German Environmental Information Network	http://www.gein.de
GEMET	GEneral Multilingual Environmental Thesaurus of EEA	http://www.eionet.eu.int/GEMET
GEMS	UN Global Environment Monitoring Systems of Earthwatch	
GEO	Group on Earth Observations	http://earthobservations.org
GEO (UNEP)	Global Environment Outlook of UNEP	http://www.grida.no/geo
GeoMIS.Bund	GeodatenMetaInformationsSystem	http://www.geomis.bund.de
GEOSS	Global Earth Observation System of Systems of GEO	http://earthobservations.org
GEWEX	Global Energy and Water Cycle Experiment	http://www.gewex.org
GEWINET	German Water Information Network	http://www.globwinet.org/germany.asp
GHCC	Global Hydrology & Climate Center in Huntsville, Alabama	http://www.ghcc.msfc.nasa.gov, see also http://www.nsstc.org/ghcc
GHCN	Global Historical Climatology Network	http://cdiac.esd.ornl.gov/ghcn/ghcn.html
GHP	GEWEX Hydrometeorological Panel	http://ecpc.ucsd.edu/projects/ghp/ghp.html
GHRC	Global Hydrology Resource Center	http://ghrc.msfc.nasa.gov
GIS	Geographic Information System	
GISD	Geospatial Information for Sustainable Development	http://ip.opengis.org/gisd/docs/20020630_GSDI_TS.htm

GIWA	Global International Waters Assessment	http://www.giwa.net
GLASS	Global Land Atmosphere System Study	http://hydro.iis.u-tokyo.ac.jp/GLASS
GLOBWINET	Global Water Information Network	http://www.globwinet.org
GMES	Global Monitoring for Environment and Security	http://www.gmes.info
GNIP	Global Network for Isotopes in Precipitation	http://isohis.iaea.org
GOOS	Global Ocean Observing System	http://ioc.unesco.org/goos
GOSIC	Global Observing Systems Information Center	http://gosic.org, http://www.gos.udel.edu
GPA	UNEPs Global Programme of Action for Protection of the Marine Environment from Land-based Activities	http://www.gpa.unep.org
GPCC	Global Precipitation Climatology Centre	http://gpcc.dwd.de
GPCP	Global Precipitation Climatology Project	http://orbit-net.nesdis.noaa.gov/arad/gpcp
GrADS	Grid Analysis and Display System	http://grads.iges.org/grads
GRDB	GRDC Database	http://grdc.bafg.de
GRDC	Global Runoff Data Centre	http://grdc.bafg.de
GRID	UNEP's Global Resource Information Database managed by DEWA	http://www.grid.unep.ch/about/network.php
GSDI	Global Spatial Data Infrastructure	http://www.gsdi.org
GSN	GCOS Surface Network	http://lwf.ncdc.noaa.gov/servlets/gsn
GSWP-2	Global Soil Water Project	http://grads.iges.org/gswp/head.html
GT-Net	Global Terrestrial Networks	http://gosic.org/gtos/GTNet_data_access.htm
GTN-H	Global Terrestrial Network for Hydrology	http://gtn-h.unh.edu
GTOPO30	30 Seconds (~1km) Gridded Earth Topography Data by USGS	http://edcdaac.usgs.gov/gtopo30/gtopo30.asp
GTOS	Global Terrestrial Observing System	http://www.fao.org/gtos
GTS	Global Telecommunication System	http://www.wmo.int/web/www/TEM/gts.html
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit/ German Agency for Technical Cooperation	http://www.gtz.de/english
GUAN	GCOS Upper-Air Network	http://www.wmo.ch/web/gcos/networks.htm
GWCC	former GEMS/Water Collaborating Centre, now GWPO	http://www.gemswater.org
GWP	Global Water Partnership	http://www.gwpforum.org
GWPO	UN GEMS/Water Programme Office of UNEP/DEWA	http://www.gemswater.org
GWSP	Global Water System Project by ESSP	http://www.gwsp.org
HAD	Hydrologischer Atlas von Deutschland, Hydrological Atlas of Germany	http://had.bafg.de
HELP	Hydrology for the Environment, Life and Policy	http://www.unesco.org/water/ihp/help
HEPEX	Hydrologic Ensemble Prediction Experiment	
HMEI	Association of Hydro-Meteorological Equipment Industry	http://www.hydrometeoindustry.org
HOMS	Hydrological Operational Multipurpose System of WMO	http://www.wmo.int/web/homs/projects/homsp1.html
HWRD	Hydrology and Water Resources Department of WMO	http://www.wmo.int/web/homs
HWRP	Hydrology and Water Resources Programme of WMO	http://www.wmo.int/web/homs
HYCOS	Hydrological Cycle Observing Systems	http://www.wmo.int/web/homs/projects/status.html
HYDAT	Environment Canada produces a National HYDAT CD-ROM which provides access to the National Water Data Archive	http://www.msc-smc.ec.gc.ca/wsc/products/hydat/main_e.cfm?cname=hydat_e.cfm
HYDRO1K	HYDRO1K Elevation Derivative Database of USGS	http://edcdaac.usgs.gov/gtopo30/hydro
HYDRONIGER	Hydrological Forecasting System for River Niger's Basin	http://aochycos.ird.ne/HTMLF/ORGINT/HYDRONIG/INDEX_EN.HTM
IACPO	International ACSYS/CliC Project Office (WMO - WCRP)	http://ipo.npolar.no
IAEA	International Atomic Energy Agency	http://www.iaea.org
IAH	International Association of Hydrogeologists	http://www.iah.org
IAHS	International Association of Hydrological Sciences	http://iahs.info
ICOLD	International Commission on Large Dams	http://www.icold-cigb.org

ICPR	International Commission for the Protection of the Rhine	http://www.iksr.de
ICSU	International Council for Science (until April 1998: Internation Council of Scientific Unions)	http://www.icsu.org
ICWC	Interstate Coordination Water Commission	http://www.icwc-aral.uz
IFNet	International Flood Network	http://www.internationalfloodnetwork.org/index_e.html
IGBP	International Geosphere Biosphere Program	http://www.igbp.kva.se
IGFA	International Group of Funding Agencies for Global Change Research	http://www.igfagcr.org
IGOS	Integrated Global Observing Strategy	http://www.igospartners.org
IGRAC	International Groundwater Resources Assessment Centre	http://www.igrac.nl
IGWCO	Integrated Global Water Cycle Observation (see IGOS)	
IHD	International Hydrological Decade 1965-1974	
IHDP	International Human Dimensions Programme on Global Environmental Change	http://www.ihdp.org
IHP	International Hydrological Programme (UNESCO)	http://www.unesco.org/water/ihp
IHP-OHP Secretariat Germany	Former name of the IHP/HWRP Secretariat Germany	http://ihp.bafg.de
IHP/HWRP Secretariat Germany	German Secretariat of the IHP of UNESCO and the HWRP of WMO	http://ihp.bafg.de
IISD	International Institute for Sustainable Development	http://www.iisd.org
ILEC	International Lake Environment Committee	http://www.ilec.or.jp
INBO	International Network of Basin Organizations	http://www.oieau.fr/riob
INSPIRE	INfrastructure for SPatial InfoRmation in Europe by the EU	http://inspire.jrc.it
IOC	Intergovernmental Oceanographic Commission of UNESCO	http://ioc.unesco.org/iocweb
IODE	IOC's International Oceanographic Data and Information Exchange	http://ioc.unesco.org/iode
IPCC	Intergovernmental Panel on Climate Change	http://www.ipcc.ch
IPCC-DDC	IPCC's Data Distribution Centre	http://ipcc-ddc.cru.uea.ac.uk
IPO	International Project Office	
IRN	International Rivers Network	http://www.irn.org
ISCCP	International Satellite Cloud Climatology Project	http://isccp.giss.nasa.gov
ISEOS	Institute for the Study of Earth, Oceans, and Space (at UNH)	http://www.eos.sr.unh.edu
ISLSCP	International Satellite Land Surface Climatology Project	http://www.gewex.org/islscp.html
ISO	International Organization for Standardization	http://www.iso.org
ISO 19115	An International Metadata Standard for Geographic Information	http://www.iso.org/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=26020&ICS1=35&ICS2=240&ICS3=70
IUCN	The World Conservation Union	http://www.iucn.org
IWLP	International Water Law Project	http://www.internationalwaterlaw.org
IWMI	International Water Management Institute	http://www.iwmi.cgiar.org
IWRA	International Water Resources Association	http://www.iwra.siu.edu
IWRM	Integrated Water Resources Management	
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology	http://ioc.unesco.org/goos/jcomm.htm
JOSS	Joint Office for Science Support / UCAR	http://www.joss.ucar.edu
LBA	Large-scale Biosphere-Atmosphere Experiment in Amazonia	http://lba.cptec.inpe.br/lba/indexi.html
LISFLOOD	The physically based LISFLOOD model has been specifically developed to simulate floods in large European drainage basins	

LOICZ	Land-Ocean Interactions in the Coastal Zone,	http://www.loicz.org
MAGS	Mackenzie GEWEX Study	http://www.usask.ca/geography/MAGS
MDB	Murray-Darling Basin Water Budget Project	http://www.gewex.org/mdb.html
MED-HYCOS	Mediterranean Hydrological Cycle Observing System	http://medhycos.mpl.ird.fr
Met Office (UK)	Meteorological Office of the United Kingdom	http://www.met-office.gov.uk
Metadata	a term used within the computer science community to denote characteristics or quality of data	
MLIT	Ministry of Land, Infrastructure and Transport in Japan	http://www.mlit.go.jp/english
MOPEX	Model Parameter Estimation Experiment	http://www.nws.noaa.gov/oh/mopex
MPI	Max Planck Institute for Meteorology	http://www.mpimet.mpg.de
MSC	Meteorological Service of Canada	http://www.msc-smc.ec.gc.ca
NAME	North American Monsoon Experiment	http://www.joss.ucar.edu/name
NAO	North Atlantic Oscillation	
NASA	National Aeronautics and Space Administration	http://www.nasa.gov
NASA-GHCC	NASA Global Hydrology and Climate Center (see GHCC)	
NASDA	National Space Development Agency of Japan	http://www.nasda.go.jp/index_e.html
NBA	Niger Basin Authority	http://www.abn.ne/homepg.html
NCAR	National Center for Atmospheric Research	http://www.ncar.ucar.edu/ncar/index.html
NCEP	NOAA's National Centers for Environmental Prediction	http://www.ncep.noaa.gov
NESDIS	NOAA's National Environmental Satellite, Data, and Information Service	http://www.nesdis.noaa.gov
NGDC	National Geophysical Data Center of NOAA	http://www.ngdc.noaa.gov/ngdc.html
NGO	Non Governmental Organisation	
NHS	National Hydrological Service	List available at http://www.wmo.ch/web/homs/projects/homs/_hnrc.html
NIES	National Institute for Environmental Studies	http://www.nies.go.jp/index.html
NIMA	National Imagery and Mapping Agency	http://www.nima.mil
NMS	National Meteorological Service	List e.g. available at http://www.wmo.int/web-en/member.html#list
NOAA	National Oceanic and Atmospheric Administration	http://www.noaa.gov
NOAA-OGP	NOAA Office of Global Programs	http://www.ogp.noaa.gov
NOKIS	Nord- und Ostseeküsteninformationssystem - North and Baltic Sea Coastal Information System	http://nokis.baw.de
NSF	National Science Foundation	http://www.nsf.gov
NSIDC	National Snow and Ice Data Center	http://nsidc.org
NWIS	National Water Information System of USGS Water	http://water.usgs.gov/nwis
NWP	Numerical Weather Prediction	
NWRI	National Water Research Institute	http://www.nwri.ca/nwri.html
Ocean.US	National Office for Integrated and Sustained Ocean Observations	http://www.ocean.us
OceanTeacher	Online Resource of IOC's IODE Programme	http://www.oceanteacher.org
OGC	Open Geospatial Consortium	http://www.opengeospatial.org
OHP	Operational Hydrological Programme of WMO, now HWRP and HOMS	
OIT	Oceans Information Technology Pilot Project	http://www.oceans-it.net
OOPC	Oceanographic Observation Panel for Climate of GCOS	http://www.wmo.int/web/gcos/oopc.htm
OSU	Oregon State University	http://terra.geo.orst.edu
PI	Pacific Institute	http://www.pacinst.org
PIK	Potsdam Institute for Climate Impact Research	http://www.pik-potsdam.de
PILPS	Project for Intercomparison of Landsurface Parameterization Schemes	http://www.cic.mq.edu.au/pilps-rice
PLATIN	La Plata Basin Intercomparison Study	http://www.atmos.ucla.edu/~mechoso/platin

QA-QC	Quality Assurance/ Quality Control	
R-ArcticNet	Regional Electronic Hydrographic Data Network for the Arctic Region	http://www.r-arcticnet.sr.unh.edu/v3.0
R-HydroNet	A Regional, Electronic Hydrometeorological Data Network For South America, Central America, And The Caribbean	http://www.r-hydronet.sr.unh.edu
RAMSAR	The Ramsar Convention on Wetlands	http://www.ramsar.org
RBI	River Basin Initiative	http://www.riverbasin.org
RBO	River Basin Organisations, lists e.g. available via River Basin Authorities or GLOBWINET	
RCH	Regional Centre of Hydrology in Central Asia	http://www.rch.uz
ReliefWeb	Natural Disasters since 1981	http://www.reliefweb.int/w/rwb.nsf/vLND
RivDis	The Global River Discharge Database	http://www.rivdis.sr.unh.edu
RiverNet	RiverNet is a multimingual service provided by the NGO ERN	http://www.rivernet.org
SADC-HYCOS	South African Development Community Hydrological Cycle Observing System	http://www-sadchyco.pwv.gov.za/sadc
SALLJEX	South American Low-Level Jet Experiment	http://www.salljex.at.fcen.uba.ar
SAWINET	Southern African Water Information Network	http://www.globwinet.org/sawinet.asp
SBSTA	Subsidiary Body for Scientific and Technological Advice of UNFCCC	
SC	Steering Committee	
SCWR	Subcommittee on Water Resources	http://ceb.unsystem.org/Former.ACC/accswr.htm
SHEF	Standard Hydrologic Exchange Format	http://www.weather.gov/oh/hrl/shef/indexshef.htm
SHI	State Hydrological Institute in St. Petersburg	http://www.hydrology.ru
SRTM	Shuttle Radar Topography Mission	http://www.jpl.nasa.gov/srtm
SSG	Scientific Steering Group	
Sv	Sverdrup: Volume flux unit, 1 Sv = 1 x 10^6 m^3/sec	
TC 211	on Geographic Information/ Geomatics: ISO Technical Committee 211: Geographic Information/ Geomatics	http://www.isotc211.org
TEMS	Terrestrial Ecosystems Monitoring Sites	http://www.fao.org/gtos/tems
TFDD	Transboundary Freshwater Dispute Database	http://www.transboundarywaters.orst.edu
TOPC	Terrestrial Observation Panel for Climate of GCOS	http://www.wmo.int/web/gcos/topc.htm
TRMM	Tropical Rainfall Measuring Mission	http://trmm.gsfc.nasa.gov
UCAR	University Corporation for Atmospheric Research	http://www.ucar.edu/ucar/index.html
UDK	Umweltdatenkatalog - Environmental Data Catalogue	http://www.umweltdatenkatalog.de
UDRS	Universal Data Reduction Server	http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/UDRS/index.shtml
UN	United Nations	http://www.un.org, http://www.unsystem.org
UN TC	UN Treaty Collection	http://untreaty.un.org
UNDP	United Nations Development Programme	http://www.undp.org
UNECE	United Nations Economic Commission for Europe	http://www.unece.org
UNECE WC	UNECE Water Convention	http://www.unece.org/env/water
UNEP	United Nations Environment Programme	http://www.unep.org
UNESCO	United Nations Educational, Scientific and Cultural Organization	http://www.unesco.org
UNESCO	IHP Databases	http://www.unesco.org/water/ihp/db
UNESCO Water	UNESCO Water Programmes	http://www.unesco.org/water
UNFCCC	United Nations Framework Convention on Climate Change	http://unfccc.int
UNH	University of New Hampshire	http://www.unh.edu
UNH-GRDC	UNH-GRDC Global Composite Gridded Runoff Fields	http://www.grdc.sr.unh.edu
UNIDART	Uniform Data Request Interface for the access to meteorological data and products	http://www.dwd.de/unidart
US-CLIVAR	US CLIVAR	http://www.usclivar.org

USGS	U. S. Geological Survey	http://www.usgs.gov
USGS Water	Water Resources of the United States by USGS	http://water.usgs.gov
USGS WW	USGS WaterWatch	http://water.usgs.gov/waterwatch
VAMOS	Variability of the American Monsoon System	http://www.clivar.org/organization/vamos
WADI	(Dutch) WAter Data Infrastructuur	http://www.wadi.nl
WaterGAP	Water Global Assessment and Prognosis (name of a model developed at CESR, including the Hydrological Model WGHM	http://www.usf.uni-kassel.de/usf/forschung/projekte/worldwater.en.htm
Watersheds of the World	Watersheds of the World of WRI, IUCN, IWMI and RAMSAR	http://www.iucn.org/themes/wani/eatlas
WaterWeb	WaterWeb Consortium	http://www.waterweb.org
WB	World Bank	http://www.worldbank.org
WBGU	German Advisory Council on Global Change	http://www.wbgu.de/wbgu_home_engl.html
WCD	World Commission on Dams	http://www.dams.org
WCP-Water	World Climate Programme-Water	http://water.usgs.gov/osw/wcp-water
WCRP	World Climate Research Programme	http://www.wmo.int/web/wcrp/wcrp-home.html
WEBS	Water and Energy Balance Study	http://ecpc.ucsd.edu/gcip
WEHAB	Water, Energy, Health, Agriculture and Biodiversity	http://www.johannesburgsummit.org/html/documents/wehab_papers.html
WGMS	World Glacier Monitoring Service	http://www.geo.unizh.ch/wgms
WHO	World Health Organization	http://www.who.int/en
WHYCOS	World Hydrological Cycle Observing System	http://www.wmo.int/web/homs/projects/whycos.html
WHYMAP	World-wide Hydrogeological Mapping and Assessment Programme	http://www.iah.org/whymap and http://www.bgr.de/b1hydro/fachbeitraege/a200401/e_whymap.htm
WMO	World Meteorological Organization	http://www.wmo.int
WCMS	WMO Core Metadata Standard (v0-2) developed by ET-IDM	http://www.wmo.int/web/www/WDM/Metadata/documents.html
WOCE	World Ocean Circulation Experiment	http://www.soc.soton.ac.uk/OTHERS/woceipo/ipo.html
WRAP	Water Resource Applications Project	http://ecpc.ucsd.edu/projects/ghp/Wrap_web
WIR	World Resources Institute	http://www.wri.org
WSRC	Water Systems Analysis Group (at UNH)	http://www.watsys.unh.edu
WSSD	World Summit on Sustainable Development	http://www.johannesburgsummit.org, http://linkages.iisd.ca/wssd/portal.html
WWAP	World Water Assessment Programme, publishes the WWDR	http://www.unesco.org/water/wwap
WWC	World Water Council	http://www.worldwatercouncil.org
WWDR	World Water Development Report	http://www.unesco.org/water/wwap/wwdr
WWW	World Weather Watch of WMO	http://www.wmo.int/web/www/www.html
XML	Extensible Markup Language	
XSL	Extensible Stylesheet Language	
ZEF	Centre for Development Research	http://www.zef.de

Annex 11 List of GRDC reports

Reference list of GRDC Reports

Report No. 1 (May 1993)	Second Workshop on the Global Runoff Data Centre, Koblenz, Germany, 15 - 17 June, 1992. (17 pp, annex 73 pp)
Report No. 2 (May 1993)	Dokumentation bestehender Algorithmen zur Übertragung von Abflußwerten auf Gitternetze. (incl. an English abstract in English by the GRDC: Documentation of existing algorithms for transformation of runoff data to grid cells) / G.C. Wollenweber. (71 pp)
Report No. 3 (June 1993)	GRDC - Status Report 1992. (5 pp, annex 5 pp)
Report No. 4 (June 1994)	GRDC - Status Report 1993. (16 pp, annex 34 pp)
Report No. 5 (Nov 1994)	Hydrological Regimes of the Largest Rivers in the World - A Compilation of the GRDC Database. (275 pp)
Report No. 6 (Dec 1994)	Report of the First Meeting of the GRDC Steering Committee, Koblenz, Germany, June 20 - 21, 1994. (10 pp, annex 38 pp)
Report No. 7 (June 1995)	GRDC - Status Report 1994. (12 pp, annex 20 pp)
Report No. 8 (July 1995)	First Interim Report on the Arctic River Database for the Arctic Climate System Study (ACSYS). (34 pp)
Report No. 9 (Aug 1995)	Report of the Second Meeting of the GRDC Steering Committee, Koblenz, Germany, June 27 - 28. (17 pp, annex 34 pp)
Report No. 10 (March 1996)	Freshwater Fluxes from Continents into the World Oceans based on Data of the Global Runoff Data Base / W. Grabs, Th. de Couet, J. Pauler (49 pp, annex 179 pp)
Report No. 11 (April 1996)	GRDC - Status Report 1995. (16 pp, annex 45 pp)
Report No. 12 (June 1996)	Second Interim Report on the Arctic River Database for the Arctic Climate System Study (ACSYS). (39 pp, annex 8 pp)
Report No. 13 (Feb 1997)	GRDC Status Report 1996 (25 pp, annex 36 pp)
Report No. 14 (Feb 1997)	The use of GRDC - information. Review of data use 1993/1994. Status: January 1997 (18 pp, annex 34 pp)

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