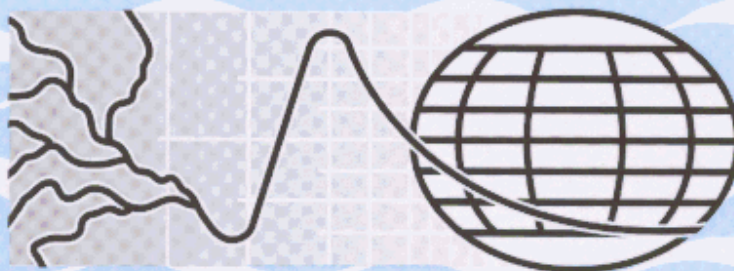


Report No. 28

**Report on the Fifth Meeting of the
GRDC Steering Committee,
Koblenz, Germany,
25 - 28 June 2001**



GRDC



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

Weltdatenzentrum Abfluss
Bundesanstalt für Gewässerkunde
Koblenz, Deutschland

Global Runoff Data Centre (GRDC)
Federal Institute of Hydrology (BfG)
Koblenz, Germany

Report No. 28

Report on the Fifth Meeting of the GRDC Steering Committee, Koblenz, Germany, 25 - 28 June 2001



November 2002

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Report of the

5th Meeting of the GRDC Steering Committee

Koblenz, 25 – 28 June 2001

Executive summary

The international Steering Committee (SC) of the GRDC met for its 5th meeting from 25 to 28 June at Koblenz, Germany.

Prof. Dr Hans-Jürgen Liebscher resigned from his position as Chairman of the GRDC SC due to his retirement from BfG. Dr Klaus Wilke, Head of the Department M2 of the Federal Institute of Hydrology (Water Balance, Forecasting Methods, GRDC) was elected as the new Chairman of the GRDC.

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.

The discussions revealed that highest priority should be given to data acquisition, development of products, database development and collaboration in specific programs and initiatives of the UN system related to water and climate. Most notably, GRDC was requested to closely collaborate in the WMO/GCOS project "Global Terrestrial Network for Hydrology (GTN-H)" as well as liaise with others in the field of meta-databases, particularly with CHy AWG and CHy Working Group on Water Resources (Expert on Data Management). Further details on main issues and results of the SC meeting are summarised in the following action table, the subsequent report and the annexes.

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 4 th 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 Data”.	12, 12.2 14.8 A.17	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
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 station data	15.2.2	GRDC to seek guidance in this critical matter from the AWG (consistency with Resolution 25 vs. consistency with open data access practice of some members...)	AWG
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
3 rd World Water Forum	16.3 A.13	GRDC to present itself at the 3 rd 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

0 General

0.1 Between the 4th meeting of the GRDC Steering Committee in June 1999 and the 5th meeting reported here, there have been changes at the GRDC, i.e. in July 2000 Mr Thomas Maurer became the successor of the former Head Mr Wolfgang Grabs and the Interim Head Mr Nestor Correa (November 1999-June 2000).

0.2 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.

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

0.4 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.

1 Opening of the meeting by the chairman and the president of BfG

1.1 The 4th meeting of the GRDC-SC was formally opened by the chairman of the GRDC Steering Committee, Mr H.-J. Liebscher 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

2.1 All member organisations of the GRDC SC (annex 3) sent at least one representative with the exception of WHO, UNESCO/IHP (covered by the representative of WWAP), ICSU/IAHS, FRIEND and the German IHP/OHP secretariat. Mr Richard Helmer (WHO) requested to be deleted from the list of participants by email of 19 February 2001, as the participation in the GRDC meeting should be through the NWRI Canada due to a change in the GEMS/Water programme. Mr Mike Bonell (UNESCO/IHP) and Mr Alan Gustard (FRIEND) sent summary reports on their respective GRDC related activities, which were distributed electronically to all participants prior to the SC meeting (see also annex 14 and 15).

2.2 The agenda of the meeting (annex 1, see also the annotated agenda in annex 2) was discussed and adopted without changes to existing items.

2.3 One of the representatives from Japan, Mr Nakao, offered to present his institution, the Foundation Of River and Basins Integrated Communications (FRICS), to the SC. The offer was welcomed and agenda item 8.7.4 was added.

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

3.1 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 (cf. annex 6).

3.2 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.

3.3 GRDC currently operates with 4 permanent staff-members, i.e. 2 academics and 2 technicians. From dedicated BfG resources, 3 more part-time staff contribute to GRDC's work equivalent to approximately one more person. According to Mr Wetzel, given the current economic situation as well as the necessity to join the Berlin branch office of the BfG with Koblenz headquarters under the constraint to reduce total staff numbers it is unlikely that GRDC staff can be increased in the foreseeable future. However he conceded the possibility to slightly increase travel-budget in future.

4 Review of decisions of the XIth Session of the WMO-Commission for Hydrology relevant to the activities of the GRDC

4.1 Mr Grabs, WMO, reported on the outcome of the eleventh session of the WMO Commission for Hydrology from 6-16 November 2000 in Abuja, Nigeria (for a summary see annex 8, for CHy see also <http://www.wmo.ch/web/homs/chy/chy.html>) and GRDC-relevant news from the Fifty-third session of the WMO Executive Council (EC LIII) held in the WMO Secretariat in Geneva from 5-15 June 2001. The most prominent topics of both meetings were: metadata, implementing Resolution 25 (Cg-XIII) of 1999 on free and unrestricted exchange of hydrological data, and WHYCOS (cf. annex 8).

4.2 Under CHy-item 11.8.2 of the report, GRDC was requested to consider setting up a global meta-database, starting with 200 discharge stations on major rivers flowing to the oceans. The suggestion is to set-up an internet-based metadata information system reporting physical and topographic features of basins, land use and hydrology. Mr Maurer added that the GRDC catalogue already features metadata of all GRDC stations with however less supplementary information (cf. agenda item 10 and annex 23). He referred to a GRDC effort that resulted in a prototype database on basin-related supplementary information for the Danube basin, the results of which are reported under agenda item 10.1 (cf. annex 24).

4.3 Under CHy-item 14 activities and plans related to the propagation and implementation of Resolution 25 (Cg-XIII,1999, see annex 34) on free and unrestricted exchange of hydrological data were discussed. Mr Grabs expressed the opinion that GRDC should contribute to the production of a Technical Note that will be developed from the

preliminary materials prepared to promote Resolution 25 and that should be widely disseminated if possible in several languages (CHy-item 14.6).

4.4 Mr Rutashobya noted with regard to the technical note concerning Resolution 25 that it revealed to be far more difficult to establish a list of data to be exchanged without charge and with no condition on use in the field of hydrology than it was for the similar Resolution 40 (Cg-XII, 1995) concerning the exchange of meteorological data. The problem will therefore be put forward on the agenda of the CHy Advisory Working Group on its first session from 17-21 September 2001. GRDC would be one example in a case study elaborating on and reviewing data policies.

4.5 Under CHy-item 17.4 it was further recommended that the subject-oriented working groups of the CHy-Advisory Working Group (<http://www.wmo.ch/web/homs/chy/awg.html>, AWG) should define projects, one on metadata and in association with the GRDC. Mr Grabs reported several intended further projects of the AWG, namely

- risk management,
- automated real time stage-discharge calculation,
- analysis of hydroclimological variability and trend,
- global/regional short-term hydrological forecasting system.

4.6 Mr Grabs explained the view of EC-LIII that at the national level the preferred way of getting hold of data which are owned by regional or sub-national authorities should be via a country's National Committees on water.

4.7 Mr Grabs reported on the activities to re-launch the World Climate Programme-Water (WCP-Water) as a joint programme of WMO and UNESCO. WCP-Water aims to promote hydrological activities in the World Climate Programme and related conventions, and provides the water community with current data and information on hydrological and water resources conditions and variations, in a climatic context, over a wide range of time and space scales. Further details are available from <http://water.usgs.gov/osw/wcp-water/>.

4.8 Mr Liebscher noted with regard to data policies, that according to the EU Council Directive on the Freedom of Access to Information on the Environment (90/313/EEC, 7 June 1990, http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=en&numdoc=31990L0313&model=guichett) information on the environment, collected by public authorities, must be provided at a reasonable cost. The term "environmental data" is defined broadly to include information on air, land, water, natural science, etc., as is the term "public authorities" which is broader than "government". The directive had to be transferred in national law until January 1993. A proposal for a revised directive has been made recently (http://europa.eu.int/comm/environment/docum/00400_en.htm). Mr Rutashobya added in this context that the EC Council Directive is not interpreted consistently by all member states of the EU, i.e. not all countries regard hydrological as well as climatological data as falling under the category "environmental data".

4.9 Mr Grabs noted that the ideas expressed in Resolution 25 are not yet widely distributed. He rather sees a need to communicate with NHS and NMS than with governments. Mr Grabs encouraged writing of papers on the topic of data exchange in journals and also publishing via glossy type of promotional materials.

5 Brief outline of GRDC's history and mile stones

5.1 Mr Liebscher reviewed the development of the GRDC in the past 20 years and its activities in its 13 years of existence (annex 7).

5.2 In the framework of the First GARP Global Experiment (FGGE) activity the WMO had been entrusted to collect river discharge data sets to be used as inputs to or validation of Global Atmospheric Circulation Model studies.

This task was initially taken over by the Institute for Bioclimatology and Applied Meteorology (Prof. A. Baumgartner) starting with a data request letter dated from 11 August 1982 by the former WMO Secretary General A.C. Wiin-Nielsen.

Due to the retirement of Prof. Baumgartner he initiated a transfer of this task after the initial phase with a letter dated from 12 April 1984.

5.3 Subsequent discussions over 2 years involving

- the WMO,
- the President of the German Weather Service (as the Permanent Representative of Germany with WMO),
- the former President Dr. Knöpp and Prof. Hans-Jürgen Liebscher of BfG,
- the German Foreign Office,
- the Federal Ministry of Education and Research and
- the Federal Ministry of Transport, Building and Housing

led finally to a permanent inclusion of GRDC costs into the Federal budget of the Ministry of Transport effective from 1988 (letters of 10 and 21 April 1986). There was also an intermediate financial support by the Federal Ministry of Education and Research in 1987 to ensure the database transfer.

The president of the German Weather Service in his role as the Permanent Representative of Germany with WMO informed WMO about this outcome with letter of 30 April 1986.

GRDC officially became operative at 14 November 1988.

6 Recapitulation of the vision statements and implementation goals developed during the 4th SC meeting

6.1 The GRDC SC recapitulated the vision statements made for the "Strategic Development of GRDC" and the goals for the "Implementation of the strategic outreach" as developed in the previous SC meeting and summarised in annex 9.

6.2 The list of vision statements and implementation goals was supported without reservation. However, it was understood that not all items can be followed up at the same time with full commitment. This should become point of discussion again at the end of the SC meeting under agenda item 16.

6.3 Mr Fraser stressed the importance and his preparedness to jointly market the interests of both organisations, GEMS/Water and GRDC.

6.4 Mr Rutashobya stressed the potential of incentives to data providers such as e.g. country reports. They might encourage countries to more generously deliver data to GRDC as the benefit of data provision becomes more obvious. Furthermore, they also might serve as good-practice templates on how to compile hydrological data in additional meaningful ways to those already applied in current hydrological yearbooks.

6.5 Mr Kinoshita suggested to attempt developing a flow chart of relations between programs, projects, NHS etc.

6.6 Regarding additional information on „Large Dams and Reservoirs“ Mr Diop added the information that the World Commission on Dams (WCD) has recently published a new report which is available from their homepage www.dams.org.

7 Summary report of GRDC activities, status and developments

7.1 Data acquisition

7.1.1 Mr Maurer reported on the data acquisition efforts of the GRDC during the last two years (see also annex 18).

7.1.2 The GRDC database was updated during 1999 with river discharge data from the following countries and regions (in parenthesis: number of stations): Canada (>400), U.K. (16), Ukraine (2), Sweden (18), Mexico (7), Russian Federation (69), Cote d'Ivoire (4), Norway (15), Austria (5), Portugal (10), Poland (12), Danube river basin (12).

During the year 2000 the GRDC database was updated with river discharge data from the following regions (in parenthesis: number of stations): Russia (1530), Basin of Mackenzie (369), Basin of Yukon (50), USA (326), Sweden (7).

The database now comprises 2533 stations featuring 70.000 station years of daily data (25 million data points) and 5621 stations featuring 160.000 station years of monthly data (1.9 million data points).

7.1.3 In November 2000, the occasion of the quadrennial WMO meeting of the Commission of Hydrology (CHy) in Abuja, Nigeria (<http://www.wmo.ch/web/homs/chy/chy.html#chy-xi>), was used to personally present individual country reports on the data situation of totally 35 countries to the respective representatives in order to foster their commitment to contribute data. The reply rate to these country reports and requests was very low to date (ongoing negotiations with two countries, Czech Republic and Democratic Republic of Congo).

7.1.4 Mr Rutashobya noted that such a reply rate of 1-5% effectively corresponds to no reply. Trust relationships have to be developed and promoted with National Hydrological Services, River Basin Authorities (RBA) and other organisations.

7.1.5 Mr Grabs mentioned a WMO initiative in 1993, where 160 countries were contacted by a letter signed by the Secretary General of WMO. That time 60 countries replied. He added, that the yearbooks of most countries lag behind for years adding to the problem of getting recent hydrological information. He also mentioned the data rescue pilot project discussed under CHy-item 18.4 (see annex 8).

7.1.6 Mr Diop noted, that African countries might have other priorities. Nevertheless Mr Wellens-Mensah promised to make available data from Ghana to the GRDC.

7.1.7 Mr Boswinkel suggested to join forces, e.g. with the developing IGRAC (see item 8.7.3) which faces the same problems.

7.1.8 Mr Fraser stressed the time required to actively communicate with data providers. This requires resourced positions on full time basis.

7.1.9 Mr Grabs stressed the need to contact national and regional organisations such as the Secretariat of the Mekong River Commission. He also suggested to contact National Focal Points such as the National Hydrological Advisor of the Permanent Representative of a country to WMO. He also mentioned the various FRIEND databases to be a potential resource for data, although FRIEND data follow different data policies than promoted by WMO and GRDC. GRDC needs a strategic approach for the future such as e.g. a liaison to the WWAP and the WWDP (see item 8.6 and annex 28).

7.1.10 Mr Wilke stressed the fact that GRDC was very successful in Abuja, however in the first place in acquiring precipitation data for the GPCC. As Mr Rudolf confirmed more than 50% of the approximately 20 enveloped GPCC requests that were distributed by the GRDC generated a reply.

7.1.11 Mr Kinoshita made the point that in his view the existence of the GRDC selection criteria constitute a superfluous obstacle in acquiring data. He suggested to ask data providers for all data, in order not to impose the task of selecting from their data bases. He suggested that WMO Congress should emphasize the topic of data exchange.

7.1.12 Mr Maurer explained the "data acquisition dilemma":

(a) Sending a request to top level attention: The high ranking persons of a data providing organisation speak English and are entitled to decide on data distribution. Even if they are positive to follow WMO-resolutions they frequently consider a data request being of minor priority among the many other important tasks they have to deal with. Thus a request often drops of their table without further notice or after it has been delegated to lower levels in the hierarchy once, but without a follow-up plan. In the majority of cases this obviously leads to loss of the request.

(b) Sending a request to "hands-on" level attention: This is typically the database manager. He is capable to draw together the information required. Regularly he is not authorised to release data without referring to his superiors or even a steering committee or similar. He might even send an inquiry but then again the obstacles mentioned under (a) become relevant.

The solution to overcome this type of problem is discipline and higher emphasis of the importance and priority of this theme.

7.2 Data dissemination and use

7.2.1 Mr Hils reported on data dissemination and use (see also annex 19).

7.2.2 The number of enquiries to GRDC decreased during 1999. About 170 downloads of GRDC database catalogues were registered in the homepage, from which a total of 47 applications were processed for data and requests of related information.

In 2000 the number of enquiries to GRDC developed non-uniformly. While there has been an increase to approximately 500 download requests from the GRDC homepage (+200 %) the number of written requests decreased to 37 (-21 %) during 2000. This presumably reflects the improved and extended offer of derived data products on the GRDC homepage. The access to the download section of the GRDC shows a strong increase. For the year 2001 an at least constant growth rate is expected summing up to an expected more than 1000 download requests.

7.2.3 Answering a question of Mr Kinoshita on the most required data, Mr Hils responded these are the most recent and up-to date time series.

7.3 Development of the database management system

7.3.1 Mr Pauler explained the database management system and major achievements during the last two years (see also annex 20).

7.3.2 A database requires continued development to enlarge the capabilities of information retrieval and to take into account the continuous development of soft- and hardware environments. The major achievements during the last two years were:

- Improvement of the tool for station-wise plausibility check and its extension to produce data sheets of station's summary statistics on monthly basis.
- Redesign and extension of the catalogue tool for easy exploration of the GRDC meta-database.
- Improvement and extension of the database concept and structure, i.e. elimination of redundancies, addition of extra information as the spatial relation of stations (upstream, downstream), storage of water level-discharge relations etc.
- Improved linkage between database and GIS.

7.3.3 Mr Grabs commented on the purpose of the plausibility tool (PT) which is to avoid obvious errors, such as typing errors, systematic errors like unit transformations etc. The PT thus ensures a basic data quality. According to the policy guidelines the final responsibility for the data quality lies with the data providers.

7.3.4 Mr Kinoshita asked whether a summation for the downstream nodes has been performed. This however will only be possible once the spatial relations between GRDC stations will be defined in the course of the overhaul of the entire catalogue and station numbering system as outlined in Mr Pauler's presentation.

7.3.5 Mr Wellens-Mensah enquired about sharing the plausibility tool (PT) with others. Though GRDC is positive about sharing the PT, in its current implementation the PT is tailor-made for the GRDB and not readily available without major reengineering. However, the concept of the PT can be shared to other interested organisations.

7.4 Development of geographic information system application

7.4.1 Mr de Couet reported on his applications of GIS and major achievements during the last two years (see also annex 21).

7.4.2 GIS-tools were developed and tested for computation and visualisation of catchments and location of gauging-stations. The developments are based on a USGS version of a global digital elevation model (DEM) called HYDRO1K-Data set (resolution 30'', <http://edcdaac.usgs.gov/gtopo30/hydro/>) and a much coarser data set (0.5°) provided by GRDC's cooperation partner University of Kassel (<http://www.usf.uni-kassel.de/usf/>) which is based on the ETOPO5 (<http://edc.usgs.gov/glis/hyper/guide/etopo5>) product of USGS (<http://www.usgs.gov/>). Both data sets provide for flow directions, flow networks, and accumulations grids. Tests on computed catchment areas showed significant differences when compared with the registered stations' metadata. It is clear that these DEMs need in part extensive manual correction of errors in order to be fully useful for the visualisation of the river network of entire regions.

7.5 Data products

7.5.1 Two data products based on GRDC discharge data are available through the internet homepage since early 1999:

- (a) monthly values of river discharge for 1,352 stations with both record lengths longer than 10 years and catchment areas larger than 2,500 km², and
- (b) monthly values of river discharge for 181 stations located close to the mouth of rivers draining into the world oceans and large lakes, with catchment areas larger than 5,000 km².

7.5.2 Incorporating GIS analysis, GRDC intends to redo the estimation of global freshwater flux into the oceans, thereby estimating the runoff from "ungauged" catchments (in terms of GRDC-stations) via the annual runoff coefficient derived from the combination of GPCC and GRDC data. 251 stations with catchment areas larger than 25,000 km² have already been identified for this purpose.

7.5.3 Mr Grabs commented on the frequently mentioned topic of "naturalised flow", i.e. back-calculating flow of present-day anthropogenically influenced situations to a pristine state. The problem is that the abstraction of water in large river basins is usually not known and the reconstruction of naturalised flows for global data sets seems not feasible in the foreseeable future. E.g. for the Ganges River an estimated 30% loss of discharge is estimated as a result of water abstraction for irrigation and subsequent evaporation. For Iceland and the USA there exist naturalised flow datasets which form subsets of the GRDC database. Another problem is posed by lakes and reservoirs that retard the flow. Without proper knowledge of the water bodies and storage time in lakes and reservoirs especially over seasons an estimation is difficult. UNH has published on that topic (Vorosmarty CJ, Sharma KP, Fekete BM, Copeland AH, Holden J, Marble J, Lough JA. 1997, The storage and aging of continental runoff in large reservoir systems of the world. *Ambio* 26: 210--219, see also <http://www.watsys.sr.unh.edu/>).

7.6 GRDC reports

7.6.1 Mr Maurer reported on GRDC-Reports (see also annex 39).

7.6.2 The following GRDC reports have been published since the fifth SC:

- No. 24, Use of GRDC Data 1993 – 1999 : A Comprehensive Summary
- No. 25: GIS-related Monthly Balance of Water Availability and Demand in Large River Basins - Case Study for the River Danube / Irina Dornblut.
- No. 26: Modelling raster-based monthly water balance components for Europe / Carmen Ulmen

7.6.3 Three further reports are in preparation: (a) a Country profile Germany with regard to water resources management featuring chapters on geophysical background but mainly on administration structures, law and legislation etc., (b) an updated edition of report number 10: Freshwater fluxes to the oceans. A total of 251 stations with catchment areas larger than 25.000 km² will be considered, i.e. a significantly improved database as compared to earlier issues (see also item 7.5) and (c) a Technical Report summarising the current situation with respect to available discharge and water stage information from freely accessible web-sites.

7.6.4 Mrs Dornblut presented her case study for the Danube River published in GRDC-Report 25 "GIS-related Monthly Balance of Water Availability and Demand in Large River Basins - Case Study for the River Danube". The methodology was developed by the Institute for Water Resources Management of the former German Democratic Republic and applied there for regional analysis. The case study aimed at exploring the applicability of the methodology for larger regions such as the Danube basin under the condition of relatively sparse input data availability. For further details refer to her presentation given in annex 22 or to the abstract given in annex 36. The merits of this methodology, namely rapid estimates of the direction towards which a water resources system might evolve under changing boundary conditions, were also presented to the World Water Assessment Programme (WWAP, cf. item 8.6).

7.7 Homepage and public relations

7.7.1 Mr Maurer reported on the GRDC-homepage (<http://www.bafg.de/grdc.htm>). The ultimate development goal is guided by his vision of becoming *the* international River portal.

7.7.2 Emphasis has been put on quick improvements of the existing GRDC homepage. A stronger commitment to ensure the topicality of the GRDC homepage is visible from the "What's new" section. The homepage now provides downloadable GRDC-reports in PDF-format as well as a much extended Download-section, offering e.g. an improved catalogue tool.

Furthermore various maps of the world-wide distribution of GRDC stations and statistics about the progress of the GRDC stations and data (status: May 2001) have been introduced.

7.7.3 However, these improvements can be viewed only as forerunners of a major redesign, which is currently in its conceptual phase. Since early spring 2001 there exists a concept for a new homepage and many text fragments have already been written to become part of the homepage (see e.g. annex 11 and 37).

7.7.4 GRDC has been present at various occasions on international meetings most notably the WWF2 in The Hague in March 2000 and the CHy meeting in Abuja, Nigeria in November 2000. Currently, GRDC heads for a display area at the International Conference on Freshwater to be held in Bonn from 3-7 December 2001 (<http://www.water-2001.de/>).

7.7.5 A new, more modern and concise version of the GRDC flyer is planned and the SC was requested to make its suggestions for the redesign.

7.8 Collaboration and co-operation

7.8.1 Though there have been significant changes in the personnel of GRDC during the last two years, GRDC has by and large succeeded to keep track of its commitments in its various collaborations and co-operations as discussed in detail under agenda items 8 and 9. The trend of this activities is to contribute to further integration of already existing data, i.e. improving the accessibility by e.g. contributions to the ISLSCP-II archive (see item 8.1.1) or the maintenance of the ARDB (see 8.1.2).

8 Status and activities of GRDC co-operations in UN-Programmes

8.1 World Climate Research Program (WCRP)

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

8.1.1.1 Mr Fröhlich gave a presentation of the various GRDC activities in the framework of the Global Energy and Water Cycle Experiment (GEWEX, <http://www.gewex.org/>), cf. annex 26.

8.1.1.2 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 (see also next item).

8.1.1.3 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) will contribute

- (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 (see also item 9.1).

8.1.1.4 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 (three 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. Furthermore, GRDC might be able to contribute to the analysis of collected time series (teleconnections).

8.1.1.5 Mr Savtchenko pointed out the need for WCRP purposes to reach at runoff data sets, that are coincident in time, i.e. that cover a common period of time. Mr Wilke responded that this is being achieved in ISLCIP II (see above) where more than 200 parameters will be available on a 0.5° grid for the period 1986-1995.

8.1.2 ACSYS/CliC

8.1.2.1 Mr Savtchenko outlined to the participants the organisational structure of the WCRP (<http://www.wmo.ch/web/wcrp/wcrp-home.html>) which is a joint Programme of WMO, ICSU and IOC of UNESCO

8.1.2.2 Mr Savtchenko explained the relation between the two projects Arctic Climate System Study (ACSYS, <http://acsys.npolar.no/>) and Climate and Cryosphere (CliC, <http://clic.npolar.no/>). ACSYS, being the only regional programme of WCRP, was initially implemented around 1994 and is currently supported until the end of 2003. CliC will be implemented as a global programme. Mr Savtchenko stressed the fact that ACSYS and CliC are 2 projects that are managed by one Scientific Steering Group (SSG).

8.1.2.3 The GRDC developed the Arctic Run-off Data Base (ARDB) on behalf of ACSYS. In May 2000, the GRDC received 3746 mean monthly station data sets from a Pan-Arctic river run-off data base compiled at the University of New Hampshire, USA. The ARDB was thereby updated in 2000 by 1616 mean monthly data sets from the territory of the former Soviet Union (these were extracted from the Pan-Arctic river run-off data base) and by daily discharge data from 56 stations in the Russian Arctic. This has helped to solve the long-standing problem of up-to-date data availability. While North American data sets are basically up-to-date (1999-2000), the Eurasian data sets mostly ended around 1988-1989. Use of the Pan-Arctic data have thus helped fill the void previously existing in the data base.

8.1.2.4 GRDC also collaborates with the ACSYS/CliC Data Management and Information Panel (DMIP, http://acsys.npolar.no/Oelke/adis_dmip.html).

8.1.2.5 Furthermore the GRDC received an update of daily data for 33 Norwegian stations. Russia announced its ability to help to update data of some of the major rivers draining into the Arctic Ocean. These data have to be digitised. Negotiations on the modalities are underway.

8.2 WHYCOS

8.2.1 Mr Grabs recapitulated that the initial concept of the World Hydrological Cycle Observing System WHYCOS (<http://www.wmo.ch/web/homs/projects/whycos.html>) was to finally arrive at a network of approximately 1000 stations around the globe that deliver hydrological and meteorological as well as environmental quality data. He explained the current concept of the development and implementation of regional HYCOS projects addressing specific needs of the regions involved. He remarked that 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.

8.2.2 Mr Grabs also reported about data exchange current problems with HYCOS projects, as e.g. that MED-HYCOS was started before WMO Resolution 25 became active and thus now many participating countries do not agree to publishing their data. Mr Portmann added that in the southern African region only around 40 out of 62 data collection platforms (DCP) were operative.

8.2.3 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.

8.2.4 The SC expressed the view that each HYCOS is obliged to forward its data to the GRDC.

8.3 G3OS (GTOS, GCOS, GOOS) and IGOS

8.3.1 Mr Grabs summarised briefly the ideas behind the Integrated Global Observing Strategy (IGOS). 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 annex 32 and <http://www.igospartners.org/>.

8.3.2 Mr Grabs pointed out that IGOS is in the process to develop a Water Cycle theme.. Specifically, the WCRP took the lead in developing a proposal for an IGOS Integrated Global Water Cycle Observation (IGWCO) theme, see http://ceos.esa.int/igosp9/docs/doc10_watertheme.doc. 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.

8.4 GTN-H (Global Terrestrial Network for Hydrology)

8.4.1 GTN-H is a recently started initiative of WMO and GCOS to establish a Global Terrestrial Network for Hydrology (GTN-H) of 10 hydrological variables, some of them on a near real-time basis.

8.4.2 Following a first meeting on the "Establishment of a Hydrological Network for Climate" in Geisenheim, Germany, in June 2000, focusing on goals and principal deliverables of GTN-H (see <http://www.wmo.ch/web/homs/documents/english/geisenheim.pdf>), an "Expert Meeting on the Implementation of a Global Terrestrial Network - Hydrology (GTN-H)" was held from 21 to 22 June 2001 at the Global Runoff Data Centre (GRDC). During the meeting GTN-H was formally established and a schedule for the tasks to be performed in a first step were defined (see annex 16 and <http://www.wmo.ch/web/gcos/Publications/gcos-71.pdf>).

8.4.3 The coordinator for the first year will be Mr David Harvey, Hydrometeorologist and Network Strategist at the Atmospheric Monitoring and Water Survey Directorate of the Meteorological Service of Canada (MSC).

8.4.4 The initial coordination group of GTN-H will consist of the following members: GRDC, GPCC, GWCC, UNH, USGS and MSC.

8.4.5 The first tasks to solve are the establishment of a web page, the write-up of an outline of five initial projects to develop some products and the completion of a mission/vision statement, the terms of reference and the formulation of a framework for implementation by the coordination group.

8.4.6 As a start for its contribution GRDC is currently compiling an overview of available online river stage and runoff data in the world wide web in order to eventually develop a system which allows to comfortably overview online available data on streamflow. Thereby GRDC is building on its experience gained within an EU research project entitled 'European Flood Forecasting System' (EFFS), see also item 9.3. Within EFFS, GRDC's part is to collect the required online discharge data in an automated mode. So far a first prototype application has been developed using BfG-funds, which imports data (that must conform to agreed standards) from FTP sites, summarises it and exports it in an unified fashion for other participants in the project. This tool will be the nucleus for an application used within the first of GRDC's GTN-H-contributions.

8.4.7 GRDC intends to summarise its current research on online available discharge and water level information in a GRDC Report pointing out the various aspects of heterogeneity of such data. The idea behind this is, that in order to find a start, GRDC heads to kick-off an integration initiative, by developing a prototype system, which seeks to integrate what currently is "easily" available. The prototype then could serve - though by no means complete - as "something to show", thus hopefully helping to convince others to join the initiative, i.e. acting as a catalyst and incentive.

8.4.8 A procedure favoured by GRDC is to first distribute the before mentioned GRDC report to organisations already providing data by the internet (15-20 countries and regions). Then, a meeting could be arranged to bring together representatives of interested data providers. They would need to compromise on a common data-exchange standard based on which a prototype of an integrated information system could operate. This could be

implemented based on a simple and robust transfer of ASCII-files by FTP or - more sophisticated - using XML. The most difficult task for GRDC in its effort to support GTN-H will be to motivate the individual contributors and make them to contribute the required resources and commitment to the project. The participants encouraged GRDC to seek ways of funding such a meeting.

8.5 UNESCO/IHP

8.5.0.1 Mr Jimbow gave a presentation on the background and status of the International Hydrological Programme (IHP, <http://www.unesco.org/water/ihp/>). The slides of his presentation are attached in annex 27.

8.5.0.2 Mr Jimbow elaborated on IHP history being the follow-up of the International Hydrological Decade (IHD) that lasted from 1965-1974. He briefly summarised the previous phases I-IV before he expanded on the current fading out phase V and the 5 major themes of the upcoming phase VI from 2002-2007:

- 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

8.5.0.3 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 .

8.5.1 FRIEND

8.5.1.1 Mr Gustard, CEH, was unable to attend, but 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>) given in annex 15.

8.5.1.2 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.

8.5.1.3 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.

8.5.1.4 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>).

8.5.1.5 Mr Grabs pointed out that GRDC is represented in the Hindu-Kush Himalaya FRIEND Steering Committee and has been tasked to head the data acquisition activities.

Currently the HKH-FRIEND database only features data acquired from the GRDC. GRDC is also represented in two working groups of Hindu Kush Himalaya FRIEND, namely the Database group and the Snow Hydrology group.

8.5.1.6 Mr Kinoshita pointed to the three volumes of the Catalogue of rivers for Southeast Asia and the Pacific, that have been published by the Asian-Pacific FRIEND.

8.5.1.7 SC encouraged GRDC to contact individual FRIENDS and try to collaborate in data acquisition and metadata compilation.

8.5.2 HELP

8.5.2.1 Mr Bonell, UNESCO provided the SC with a draft bureau document on the joint UNESCO/WMO Programme "Hydrology for the Environment, Life and Policy" (HELP, <http://www.nerc-wallingford.ac.uk/ih/help/>) as well as the minutes of a HELP Basin Review Meeting from 6-8 March 2001, in Wallingford, UK. A summary on HELP is given in annex 14. A full HELP background document (Help Strategy Document) is available from http://icm.landcareresearch.co.nz/Library/project_documents/help.htm

8.5.2.2 Mr Liebscher informed the SC about HELP which is a UNESCO/WMO programme led by UNESCO. 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.

8.5.2.3 The vital importance of water in sustaining human and environmental health is the key driving force behind HELP. However, no international hydrological programme has addressed key water resource issues in the field and integrated them with policy and management needs. HELP will change this by creating a new approach to integrated catchment management. The new approach is to use real catchments, with real water related problems as the environment within which hydrological scientists, water resources managers and water law and policy experts can be brought together.

8.5.2.4 SC was of the view that no immediate action is required regarding HELP but rather it was recommended to keep informed of the developments related to HELP

8.6 WWAP/WWDR

8.6.1 Mr Jimbow gave a presentation on the background and status of the World Water Assessment Programme (WWAP, <http://www.unesco.org/water/wwap/>),. The slides of his presentation are attached in annex 28.

8.6.2 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.

8.6.3 The WWAP is an initiative of joint initiative of the water programmes and activities of the UN, supervised by the Subcommittee on Water Resources (SCWR) of the Inter-Agency Committee on Sustainable Development (IACSD). Recently, the SCWR 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/>). The future coordination mechanism is still under review.

8.6.4 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.

8.6.5 The WWDR will be a periodic review, continuously updated, designed to give an authoritative picture of the state of the world's freshwater resources and our stewardship of them. The WWDR will be the major component of the UN World Water Assessment Programme. It will contain indicators and analysis that will identify, diagnose and assess:

- The effectiveness of societal stewardship of global freshwater resources including the broad institutional and socio-economic context of water resource utilisation;
- The supply, demand and uses for water and the challenges of extreme events;
- Current critical problems and emerging threats to freshwater ecosystems and their management;

8.6.6 Mr Maurer reported that GRDC has offered to contribute to the report by its data and by application of the WABAL methodology (see agenda item 7.6) in the context of case studies requested for the WWDR.

8.6.7 GRDC has participated in two recent 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.

8.6.8 Mr Grabs noted that the clients of the WWDR are besides the IACSD the member countries of the UN. He further stressed the need of GRDC to participate in the WWAP. GRDC, as WMO's operative organisation needs a clear picture of what it can contribute to WWAP, to the present and future reports.

8.6.9 Mr Diop mentioned the UNEP-led programme Global International Waters Assessment (GIWA, <http://www.giwa.net/>) that itself develops case studies.

8.6.10 Mr Rutashobya scrutinised the criteria for selection of the case studies and wondered why South America was not reflected in the selection. Mr Grabs replied that though the case studies like footprints around the globe should cover different national, geographic and socio-economical regions, given the time pressure not all regions will be reflected in the 1st report to be presented at WWF3, Kyoto, March 2003, but rather one had to pragmatically choose regions where data is readily available.

8.6.11 Mr Maurer explained his thoughts on one fundamental prerequisite for ensuring the sustainability of WWAP, namely the development of a coordinated scheme of data management involving a generic database standard and a geo-referenced meta-database. In his experience and as is well-known in software-engineering practice, a thoroughly designed

database and access to it serves as a natural coordination mechanism. Mr Grabs noted that WWDR is not a data-based effort in the first place but an effort based on information. The SC encouraged the GRDC to closely liaise with WWAP in relevant aspects of information management.

8.7 Global data centres

8.7.1 GWCC (GEMS/Water Collaborating Centre)

8.7.1.1 Mr Fraser gave a presentation on the status of the GEMS/Water Collaboration Centre (GWCC, <http://www.cciw.ca/gems/>). The slides of his presentation can be viewed in annex 29.

8.7.1.2 Mr Fraser reported briefly of the recent review of the GEMS/Water Programme by three independent consultants under contract of UNEP (<http://www.unep.org/>). The review has been conducted successfully. What is emerging from it looks very positive for GWCC with a full recognition of GEMS/Water as an important programme in UNEP's freshwater activities.

8.7.1.3 GRDC and GWCC are mutually promoting their respective data sampling missions.

8.7.1.4 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.

8.7.2 GPCC (Global Precipitation Climatology Centre)

8.7.2.1 Mr Rudolf gave 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>). The slides of his presentation can be viewed in annex 30.

8.7.2.2 GPCC is a major component of GPCP which was established by the WCRP in 1987. GPCC started in 1988. Its data starts from 1986 until today. The near-real-time data originate from the Global Telecommunication System (GTS) of WMO's World Weather Watch (WWW) and comprise approximately 5000-7000 stations which are transferred into gridded GPCC products with approximately 2 months delay. Together with additional meteorological data acquired by the centre up to 40000 stations are stored in the database.

8.7.2.3 Mr Rudolf informed about the success rates of acquisition by various channels:

- WMO circular letter: 2%
- Recommendations by Commissions like e.g. the Executive Council: 0 %
- Bilateral contact of DWD, involving software incentives: 20%
- Writing individual letters to the persons: 20 %
- Personal contact: 60 %

8.7.2.4 Mr Rudolf thanked GRDC for support in acquiring GPCC data, most notably the successful acquisition at the CHy meeting in Abuja.

8.7.2.5 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.

8.7.2.6 Experience shows that around 6% of the data are questionable. Closer inspection reveals half of this data to be erroneous. A trained person can visually check up to 800 stations in one week.

8.7.2.7 The SC recommended 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.

8.7.3 IGRAC (International Groundwater Assessment Centre)

8.7.3.1 Mr Boswinkel gave a presentation on the background and status of the International Groundwater Assessment Centre (IGRAC). The slides of his presentation can be viewed in annex 31. For further information see e.g. <http://www.iah.org/News/2002/021.html> and <http://unesdoc.unesco.org/images/0012/001260/126082e.pdf>.

8.7.3.2 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.

8.7.3.3 The Netherlands Institute of Applied Geoscience TNO has been proposed to establish and accommodate IGRAC. Now negotiations on funding with the Dutch Government are scheduled.

8.7.3.4 Mr Grabs reported of EC-LIII which considered the CHy-XI report. EC-LIII approved Recommendation CHy-XI-1 that requests the Secretary-General of WMO to collaborate with the Director-General of UNESCO in facilitating the establishment of IGRAC, in particular by mobilising financial support, setting up an International SC and close coordination with other UN bodies, most important UNEP and IAEA.

8.7.3.5 Mr Liebscher noted that groundwater as well as soil moisture and evapo transpiration is neglected in all international programmes.

8.7.3.6 Mr Rutashobya commented on Mr Boswinkel's statement that IGRAC will neither finance the development of monitoring infrastructure nor the operation of such infrastructure and recommended not to exclude such funding. Mr Boswinkel responded that funding of infrastructure is beyond the capacity and scope of objectives of IGRAC and recommended to look for other sources of funding, primarily in the context of national and regional projects related to groundwater.

8.7.4 FRICS (Foundation of River and Basin Integrated Communications)

8.7.4.1 Mr Nakao gave a presentation on the Foundation of River and Basin Integrated Communications (FRICS) and its Water Information System at www.river.go.jp.

8.7.4.2 FRICS is an organisation that works for the River Bureau of the Ministry of Land, Infrastructure and Transport of Japan (MLIT, <http://www.mlit.go.jp/english/>), the former Ministry of Construction. FRICS receives and processes diverse river information from various sources, such as the national government and local public bodies and disseminates it to organisations and individuals in particular river basins on an as-needed basis. The system collects data such as rainfall and water levels using special data acquisition equipment (26 radar sensors for rainfall and telemetry devices) positioned along a river or in a river basin. Data is relayed to specified destinations through a dedicated microwave line linking the MLIT and Regional Bureaux.

8.7.4.3 The river information system has been developed to promptly and accurately communicate river information that can be used to make sound judgements based on composite conditions in widespread areas. Decisions include not only actions to be taken in case of floods or droughts but also measures for proper day-to-day river management.

8.7.4.4 FRICS has a clearinghouse function for water related information in Japan, using GIS and is able to perform compound queries with other databases especially environmental databases. FRICS capabilities make it the perfect location to become the Japanese GRDC focal point for data provision. This needs to be clarified, either directly or via contacting the River Bureau.

9 Other Collaborations

9.1 University of New Hampshire, United States

9.1.1 SC was briefed about the ongoing contact between researchers of UNH and GRDC.

9.1.2 GRDC cooperates with the Complex Systems Research Center (<http://www.csrc.sr.unh.edu/>) at the Institute for the Study of Earth, Ocean and Space of the University of New Hampshire (<http://www.eos.sr.unh.edu/>), to produce the gridded “Global Composite Runoff Fields on Observed River Discharge and Simulated Water Balances” to estimate the long-term averaged monthly runoff. The results are reported in GRDC-Report 22 and at <http://www.grdc.sr.unh.edu/>. In this respect, a CD has also been produced

9.1.3 In an ongoing collaboration GRDC and UNH produce their next joint product, a time series of composite runoff fields covering the time period (1986-95) for the ISLSCP II initiative (cf. 8.1.1) .

9.1.4 GRDC further was invited (as was GPCC) to participate in the proposal of a project entitled "Global Rapid Integrated Monitoring System for Terrestrial Water Cycle and Water Resource Assessment (Global-RIMS)" proposed to NASA as a response to their recent Research Announcement (NRA-00-OES-07). This project is a natural extension of current

work in the development and dissemination of high quality runoff datasets at the global scale. The intended system will combine state-of-the-art hydrographic monitoring techniques and knowledge of the distributions of human population and water-dependent infrastructure. A set of retrospective and operational hydrographic and water scarcity index data sets will be produced and distributed. The expertise, hydrologic analysis tools, and observational time series already are in place for the proposal research team to create a Global-RIMS. From ongoing work, UNH is prepared to routinely assimilate and merge NWP, remotely-sensed precipitation, and observed discharges to produce consistent, mass-conserving global data sets depicting the terrestrial water cycle. UNH also has developed or has access to high resolution mapping of rural and urban population, water infrastructure, and water use statistics.

9.1.5 The development of semi real-time composite data products as outlined in the Global-RIMS proposal is an exciting new opportunity for GRDC to offer value added products derived from GRDB data holdings.

9.1.6 This project will perfectly combine to GRDC's and UNH's commitment in the framework of GTN-H to foster the aggregation and integration of online available discharge data as outlined under agenda item 8.4.

9.2 University of Kassel, Germany

9.2.1 SC was briefed about the ongoing collaboration project between researchers from the Center for Environmental Systems Research (CESR) of the University of Kassel, Germany (<http://www.usf.uni-kassel.de/usf/>).

9.2.2 CESR is developing a global model of runoff, water availability and water use in drainage basins, WaterGAP (*Water - Global Assessment and Prognosis*). The spatial resolution of the model is 0.5°, with each cell being part of a drainage basin, a country and a world region. The purpose of the model is to assess the impact of global change on water scarcity and floods. Global change here refers to climatic change as well as to demographic, economic and technological change. Used for quantitative scenario analysis, WaterGAP will help to identify appropriate water management measures.

9.2.3 With results from WaterGAP 1, CESR contributed to the Annual Report 1997: World in Transition: Ways Towards Sustainable Management of Freshwater Resources by the German Advisory Council on Global Change (WBGU).

9.2.4 At the CESR, an improved version of WaterGAP, WaterGAP 2 has been developed. Different from WaterGAP 1, the hydrological module includes not only a vertical water balance but also lateral routing. Besides, the representation of lakes, reservoirs and wetlands is highly improved. In order to be able to simulate river discharge in a realistic manner, it was necessary to calibrate the hydrological model against time series of observed discharge.

9.2.5 In this framework GRDC provided discharge data of approximately 1100 stations to CESR. In return CESR agreed to deliver their local drainage direction map (resolution 0.5° by 0.5°), which was considerably improved by manual comparison of automated generated results with available mapped information.

9.2.6 With the calibrated model, CESR will assess the impact of climate change on discharge at the stations and make this information available to GRDC.

9.3 European Flood Forecasting System (EFFS)

9.3.1 Mr Fröhlich gave a presentation on the European Flood Forecasting System (EFFS) and GRDCs contribution to EFFS (see annex 25 and <http://effs.wldelft.nl/>).

9.3.2 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.

9.3.3 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

9.3.4 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 (cf. agenda item 8.4.)

9.3.5 Mr Fröhlich stressed the difficulties in convincing the potential data providers to deliver data for this project. Out of 27 European contacts only 8 responded and from these only 3 actually sent data so far.

9.3.6 Mr Rudolf saw serious problems that would need in-depth consideration in the simulation of snowmelt as well as in the accurate forecast of the impact region of forecasted precipitation. This is crucial with respect to the proper spatial allocation of precipitation input to models and thus finally to flood occurrence in the model.

9.3.7 Mr Nakao stressed the importance of near real time data in a coordinated time window to ensure accuracy of forecasts.

9.4 United States Geological Survey (USGS)

9.4.1 SC was briefed about its collaboration with USGS (<http://www.usgs.gov/>).

9.4.2 GRDC maintains close links to the USGS, which is one of the few services which sends updates of discharge data on a regular basis.

9.4.3 GRDC also is in contact with the team which developed the National Water Information System (NWIS) <http://water.usgs.gov/nwis> and on top of this the visualisation tool called Water Watch <http://water.usgs.gov/waterwatch> (Mr Harry Lins). This contact will be especially helpful with respect to the development of a similar tool for the world in the framework of GTN-H (cf. agenda item 8.4).

9.5 Model Parameter Estimation Experiment (MOPEX), United States

9.5.1 SC was briefed about the Model Parameter Estimation Experiment (MOPEX, <http://www.nws.noaa.gov/oh/mopex/>)

9.5.2 A high priority of MOPEX is to assemble historical hydrometeorological data and river basin characteristics for about 200 intermediate scale river basins (500 - 10 000 km²) from a range of climates throughout the world. The data sets to be developed would not be model specific and would be appropriate for developing parameter estimation schemes for most, if not all, hydrologic models land surface parameterisation schemes of atmospheric models. These data are freely available through a web site to the scientific community both for MOPEX research as well as for other global hydrological research.

9.5.3 Potentially useful data for the MOPEX project include daily and monthly streamflow data for drainage areas ranging from about 1000 sq. km. to about 50,000 sq. km. Basins smaller than 1000 sq km generally do not have a dense enough network of precipitation gages to get sufficiently accurate estimates of basin average precipitation. Basins larger than about 50,000 sq km have a greater likelihood of significant upstream regulation and tend to be too large to model using lumped hydrologic models for the entire basin. The period of record needed is at least 10 years.

9.5.4 During a meeting at GRDC's office in spring 2001 with John Schaake of the US National Oceanic and Atmospheric Administration (NOAA), it appeared as if there may be as many as several hundred GRDC stations the basins of which could meet these MOPEX criteria, especially for monthly data but many daily stations seemed to be available as well.

9.5.5 The GRDC will provide the desired streamflow data to scientists participating in MOPEX. The procedure will be for each scientist to get the streamflow data directly from the GRDC. The MOPEX web site will provide appropriate guidance for scientists to get streamflow data from GRDC.

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

9.6.1 SC was briefed about GLOBWINET (<http://www.globwinet.org/>), 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.

9.6.2 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.

9.6.3 GRDC has also 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.

10 Metadata and databases

10.1 Current activities and developments related to meta-databases

10.1.1 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

10.1.2 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.)

10.1.3 Mr Maurer presented GRDC's views on station and basin related metadata as well as the need to use integrating technologies to the SC (annex 23). He also gave examples of existing solutions.

10.1.4 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 > 5600 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

10.1.5 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 (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.

10.1.6 Picking up this request GRDC started a test to build up a prototype of a more comprehensive meta-database using a DMS (document management system).

10.1.7 Mrs. Dornblut gave a presentation on a "Prototype of a document meta-database for the Danube river basin" (annex 24). For the prototype approx. 100 documents related to the Danube river were scanned and classified according to a number of criteria. From this experience GRDC estimates the resources required to establish such a database of 200 river basins featuring approx. 100 documents each ranging from 10 to 40 man-years of work for discovery, extraction, description and archiving.

10.1.8 GRDC does not regard maintaining such a system as a feasible task for a small centre like the GRDC.

10.1.9 SC was of the view that GRDC should not work towards this goal alone but rather join forces together with other ongoing activities as e.g.

- CHy-Advisory Working Group and its Member responsible for international data exchange, Mr J. Wellens-Mensah from Ghana,
- CHy Working Group on Water Resources and its Expert on Data Management, Mr M. Kaneki from Japan whose task it will be to identify metadata standards in collaboration with NHS, HYCOS and GRDC.

10.1.10 Mr Wellens-Mensah advised to keep the vision, but on the other hand be practical.

10.1.11 Mr Kinoshita, under the impression of "very troublesome" experiences during the compilation of the Asian Pacific FRIEND River Catalogue, urged to clearly define what is metadata and to limit the number of metadata entries. He was of the opinion that metadata in the GRDC by no means should be the same as those stored with the individual NHS.

10.1.12 Annex 12 lists the results of a brainstorming session on meta-databases that aimed to summarize the various opinions of the members of the SC. The opinions have been summarised by the plenum in the following major categories:

GRDC should...

- ...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 as...
(see annex 12)
- ...consider general comments and recommendations as... (see annex 12)

10.2 Rescue of evaporation data (WMO)

10.2.1 As was pointed out at the 4th SC, data on evaporation is not yet collected in a global database. However there is data available in the member countries. In order to save this data it should be collected in an one-time activity and be stored in a static database. The static database file then should be provided via an web page.

10.2.2 The 4th SC realized that GRDC will not be able to acquire and to digitize such data. GRDC will rather store evaporation data that is already in electronic form in a database and offer it as a static database-file on its homepage.

10.2.3 WMO will write the acquisition letters to the individual members and forward the response to GRDC.

10.3 Lakes and Reservoirs (ICOLD, ILEC)

10.3.1 The 4th GRDC SC had recommended that a global database on lakes and reservoirs is required, linking the GRDC database and the GEMS/Water database. A detailed proposal for the establishment of such a database should be discussed inter alia with ICOLD, ILEC, GRDC and GEMS/Water. SC proposed that GRDC and GEMS/Water should lead the discussion initially.

10.3.2 However, in the meantime a draft proposal of the State Hydrological Institute of St. Petersburg on the establishment of an international centre of data on hydrology of lakes and reservoirs has been developed.

10.3.3 Mr Grabs reported that Russia via the State Hydrological Institute (SHI) in St. Petersburg now is in the process to develop the concept for a database on lakes and reservoirs which ultimately is expected to lead to the formal establishment of such a centre. Technical assistance for the SHI from GRDC may be required.

10.3.4 SC recommended close links of information to develop between the new emerging centre at SHI and GRDC. Both should also liaise with the International Commission on Large Dams (ICOLD, <http://www.icold-cigb.org/>) and the International Lake Environment Committee (ILEC, <http://www.ilec.or.jp/>).

11 Review of GRDC collection criteria for discharge stations

11.1 Mr Maurer introduced the current practice. The collection criteria for GRDC data should address the needs of different user groups. In the past the following collection criteria had been collated and served as guidelines for GRDC's collection efforts:

Criteria originating from UNESCO:

- annual average discharge > 100 m³/s
- basin size > 100.000 km²
- basin population > 1.000.000 inhabitants

Criteria originating from GRDC:

- rivers which reflect the hydrological regime of a region or part of a country best
- rivers which are economically important in terms of population density and/or agrobased or industrial production
- rivers which drain into the oceans or have an internal drainage

Criteria originating from GEMS/Water:

- baseline-stations, representing relatively small basins with natural flow conditions which serve as reference stations for natural or quasi-natural hydrological regimes
- trend-stations (large rivers, antropogenic. influence), long time series, having decades of discharge data available to detect trends in streamflow as a result of climate variability or change
- flux-station, situated at the mouth of rivers into the oceans to calculate the continental freshwater runoff into the oceans
- impact-stations (mostly small catchments), e.g. change due to construction of reservoirs, impact of urban areas, changes in agricultural practices and land use, local effects

11.2 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.

11.3 SC recommended that GRDC develop an information note on the collection criteria for GRDC stations.

11.4 Annex 11 presents a draft of a note entitled "Information note on GRDC station selection criteria, data format and data transfer" as prepared by GRDC after the 5th SC closed. 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 is requested and invited to discuss the draft information note in subsequent meetings.

12 Quality assessment and quality control of GRDC data

12.1 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.

12.2 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. SC was

of the opinion that such a meeting is still desirable. 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.

12.3 Mr Maurer reported of his efforts following up this matter. In annex 17 the email discussion on data quality assessment and control between GRDC and Mr Paul Pilon of Environment Canada, who was one of the major advocates for this kind of meeting during the 4th SC, is presented (March-May 2001).

12.4 After presentation of Mr Pilon's concept the email discussion went on to elaborate the feasibility of reaching the goals of this effort. In particular GRDC, with its limited capacity as summarised under agenda item 3.3 expressed reluctance to take the lead in such an ambitious endeavour. Further on, GRDC felt that the tasks and steps outlined by Mr Pilon are part of what already stands high on the agenda of WMO and other UN-organisations respectively programmes. New activities should rather head for an improved coordination of on-going activities than starting yet another initiative. SC was invited to reflect on the ideas expressed in the correspondence.

12.5 Mr Kinoshita pointed to the WMO "Guide to hydrological practices" (WMO-No. 168) and his 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.

12.6 Mr Grabs added related information 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 Coudrain-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.

12.7 Mr Kinoshita stressed the importance of rating curves when judging on the quality of a station. He recommended that GRDC should consider to integrate rating curves into the database and its quality assurance activities. Mr Maurer responded that in the scope of the GTN-H project the database model has been already extended to additionally store time variant rating curves. Though Mr Maurer regarded Mr Kinoshita's proposal as very desirable in

principle he doubted the feasibility in practice, as it would require a much closer contact to the data providers throughout the world than currently is reality.

12.8 Mr Liebscher recommended that GRDC should continue its current practice. He also proposed GRDC to produce a technical note on its current practice regarding the plausibility checks.

13 Review of GRDC data acquisition strategy

13.1 Data acquisition is the core activity of GRDC and fundamental to its success. Not many countries however send their data digitally or in the form of yearbooks in an institutionalised, regular manner. SC recognised the limited resources of GRDC and recommended that GRDC develops 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.

13.2 Mr Grabs noted the 1993-action of sending a circular letter to all WMO member states signed by the Secretary-General of WMO (SG), which led to approximately 60 responses. Mr Rudolf inquired, whether sending a personally signed letter by the SG is still possible. Mr Savtchenko replied that this is possible, in principle.

13.3 Mr Kinoshita pointed to the fact that the rotation of staff in data providing institutions is often fast and that for this reason no routine might establish. For Japan he recommended to write to the Head of the River Planning Division under the River Bureau of the Ministry of Land, Infrastructure and Transport (MLIT, <http://www.mlit.go.jp/english/>).

13.4 Mr Grabs recommended to address the Hydrological Advisors of the Permanent Representatives of a country to WMO and by carbon copy the Permanent Representative (usually the Director or Secretary-General of NMS). The names are available via WMO-HWRD.

13.5 Mr Wellens-Mensah suggested to distribute a short bulletin or newsletter, especially to potential data providers.

13.6 Mr Rutashobya also stressed the importance ensuring the feed back loop to demonstrate the gratitude towards the data providers. Other options are sending of reports generated by means of the data provided. Furthermore, the type of incentive required might well be dependent from the target region, e.g. Africa and Asia. Mr Grabs added that often little things such as spare parts for devices or books help to trigger readiness for cooperation.

13.7 On the issue of data not available in digital format the following statements were made by Mr Grabs: in general GRDC offers to digitise the data. However there is the possibility to offer a small financial incentive to digitise data at the local data providers centre. In this case however it will be necessary beforehand to prove that trustworthy data of significant basins will be delivered. This way GRDC can spend maximum a few thousand Euro per year.

13.8 Regarding the priorities of where to concentrate GRDC's up-dating capacity SC suggested to emphasis up-dating of the already existing project data sets of approximately 200 stations on rivers close to the oceans and the 1300 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.

13.9 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.

14 Re-iteration of the long term strategic development of GRDC

14.1 The SC reviewed and endorsed the vision statements and implementation goals made for the "Strategic Development of GRDC" and the goals for the "Implementation of the strategic outreach" as developed in the previous SC meeting and summarised in annex 9. SC recognised however that the goals need to be prioritised and laid down in an activity plan (see item 15 below). The discussion of the SC in this respect is summarised below

14.2 SC recognised that GRDC is not formally a WMO World Data Centre (see also SC-4, item 7.13, cf. annex 9). SC recommended that CHy should be of assistance to clarify the role of the Centre as compared to the role of WMO World Data Centres. SC recommended to put this question forward to AWG.

14.3 Regarding the preparation of an overview of GRDC's contribution to major global projects (SC-4, item 8.2, cf. annex 9) SC recommended to publish it on the GRDC homepage.

14.4 Regarding the advice to jointly market GRDC and GEMS/Water programs vice-versa (SC-4, item 8.3, cf. annex 9) it was added that this should be applied also to GPCC and the upcoming IGRAC.

14.5 Regarding the organisation of a "Products Workshop" (SC-4, item 8.7, cf. annex 9) SC stressed the importance of products and thus continued to support this item. In the discussion, the SC identified two types of products, each involving another group of clients:

- (a) Products to assist NHSs to market their services. This would require a workshop on marketing emphasising to turn the service from data collecting to service to the society, i.e. service providers. The idea was expresses to invite around 20 representatives of the technical level of NHSs in data sparse regions. In the preparation of such a workshop, use should be made of information obtained from NHSs through a well-designed questionnaire. Mr Grabs stated that WMO will try to find and allocate funds to support few of these participants. Though the question how a meeting like this could be financed was not clarified SC recommended that such a workshop should be planned and executed as it serves to be an excellent public relations activity for GRDC and would provide a useful platform for NHSs to discuss their services to the public.
- (b) The second type of product are those not meant as incentives but as global or regional analyses for clients from the global research and assessment community such as GEWEX,

WCP-Water, IPCC or WWAP. In this case participants should be representatives of these organisations plus those from the various data centres such as GPCC, GWCC, IGRAC.

14.6 Regarding the topic of metadata collection (SC-4, item 8.8+8.9, cf. annex 9) reference is made to the discussion under item 10.

14.7 Regarding the topic of lakes and reservoirs as well as dams (SC-4, item 8.10, cf. annex 9) reference is made to the discussion under item 10.3

14.8 Regarding the topic of definition and implementation a quality assurance program (SC-4, item 8.13, cf. annex 9) reference is made to the discussion under item 12.

14.9 Regarding the compilation of a searchable, comprehensive database of data providers and users (SC-4, item 8.15, cf. annex 9) SC was informed that such a database already exists based on MS-Outlook. SC recommended to publish the contacts on the GRDC web page.

15 Review of GRDC policy for the acquisition and dissemination of data

15.1 Overview of internationally applied data policies

15.1.1 WMO Resolution 25 (Cg-XIII) of 1999, which calls for free and unrestricted international exchange of hydrological data and products well complies with the concept that data acquired from public funds in a civil service structure should be freely accessible and unrestricted for the benefit not only to the national population (who paid indirectly for the data acquisition with their tax contribution), but also to the scientific community whose research results are regional or even global in nature so that a transnational benefit can be achieved. Access to and exchange of information is also perceived as a confidence building measure between and across nations. Though other concepts exist (as e.g. summarised in a paper presented by Mr Grabs at the 3rd International Friend Conference in 1997, see annex 35) they are not compliant with the spirit of current trends regarding data exchange.

15.1.2 Four basic models of data transfer can be identified:

- (1) free, unrestricted, uncontrolled access
- (2) dissemination to identified users only
- (3) data for project participants only
- (4) Case-to-case decision

15.1.3 SC was informed about the first session of the EC Advisory Group on the International Exchange of Data and Products (EC-AGE-1) in Geneva, 29 January to 1 February 2001 and its discussion relating to Resolution 25 (see annex 34). Under the reports item 5.5 (report at <http://www.wmo.ch/web/pla/>) the group requested that CHy review certain data policies relating to hydrological data and products which have been established prior to the adoption of Resolution 25 (Cg-XIII), with the view of seeking the consistency of these policies with Resolution 25 (Cg-XIII). Under item 5.6 note was also taken of the advice offered by CHy on the need to initiate systematic sampling of data transfer at national, regional and international levels as a means of monitoring the implementation of the Resolution.

15.2 Proposal

15.2.1 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 subject of discussion (also cf. annex 10).

15.2.2 The proposal was made 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)

The question need to be discussed on the background of the technical note of P. Mosley, already discussed in the first session EC Advisory Group on the International Exchange of Data and Products (EC-AGE-1) in Geneva, 29 January to 1 February 2001 (report at <http://www.wmo.ch/web/pla/>).

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 (see annex 10). The SC decided to seek guidance in this critical matter from the AWG.

15.2.3 SC recommended to create a facility to send a GRDC User Declaration electronically from the GRDC homepage to release data users from sending a declaration by fax.

16 Future GRDC activities - discussion of work plan and priority list

16.1 Based on the results of the discussion of the various agenda items, Mr Maurer requested the SC for guidance in prioritising the many proposed activities in the light of the limited resources of GRDC.

16.2 For that purpose SC subdivided GRDC activities in 10 classes and attached their relative priorities by a polling procedure. This should serve as guidance for the allocation of resources in the operation of GRDC:

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.

16.3 Furthermore, various ideas were expressed during the polling procedure as collected in annex 13. Most of them have been mentioned under the respective items of this report.

Further recommendations include:

- GRDC should present itself at the 3rd World Water Forum in March 2003 in Japan
- References to publications on scientific research supported by GRDC data should be listed on the GRDC homepage, if possible be linked
- GRDC should publish a list or map of recent data provisions to the GRDC

16.4 Mr Grabs recommended to GRDC to make use of additional resources by outsourcing some of the tasks to collaborators, external consultants, students etc. Mr Maurer agreed to this view in principle, however stressed that this practice also has its limitations as outsourced tasks have to be coordinated and supervised and thus require capacity.

17 Review of membership of the Steering Committee

17.1 The membership of the GRDC-SC was discussed.

17.2 WHO had signalled its withdrawal from its membership, stating that their interests have shifted away from freshwater issues in the context of GRDC and GEMS/Water.

17.3 Although the World Bank is a member of the SC, there has been no representative attending the SC-meetings since 1994.

17.4 SC therefore suggested to delete WHO and the World Bank from the SC member list.

17.5 On the other hand SC recommended that

- WWAP (World Water Assessment Programme) and
 - the upcoming IGRAC (International Groundwater Assessment Centre)
- should be represented at the SC.

17.6 Finally a discussion arose about the representative of a developing country from WMO regions not represented in the SC. Suggestions to invite representatives from all regions came up but were regarded as not feasible due to financial constraints for support of their attendance. The question was not resolved and SC requested guidance from the AWG in this matter.

17.7 In any case a representative from Africa would be again available through Mr Wellens-Mensah being a member of the CHy-Advisory Working Group responsible for international data exchange and thus the CHy representative to the GRDC SC.

17.8 After discussions, SC agreed to propose the following membership of the GRDC-SC for approval by the Advisory Working Group of CHy:

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

- 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

18 Election of the new chairman

18.1 The chairman, Mr Hans-Jürgen Liebscher, has retired from his long lasting service for the German Federal Institute of Hydrology in May 2001. After serving the GRDC as chairman since its official inauguration at 14 November 1988 he therefore resigned from his function in the GRDC SC as well.

18.2 Mr Klaus Wilke, Head of the Department M2 of the German Federal Institute of Hydrology (Water Balance, Forecasting Methods, GRDC) was elected as the new chairman of the GRDC. He pointed out the possibilities of the Department M2 to support GRDC with its resources. Mr Grabs thanked both the leaving and the coming chairman for their commitment.

19 Date and venue of next meeting

19.1 It was agreed that the fifth meeting of the Steering-Committee should be held around the end of June 2003 in Koblenz, after WMO Cg-XIV in May and specifically after WMO EC-LV.

20 Closure of meeting

20.1 The SC Meeting was formally closed by the leaving Chairman Mr Liebscher. The Steering Committee acknowledged and thanked the staff of the GRDC for the organisation of the meeting and the continued commitment to the advancement of the GRDC.

Annex 1

Agenda of the meeting

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

Provisional Agenda (Status 15 June 2001)

<i>time</i>	<i>duration</i>	<i>item</i>	<i>topic</i>	<i>contributions from</i>
Monday 25 June 2001				
9:00	0:10	1	Opening of the meeting by the chairman and the Director of BfG	Liebscher / Wetzel
9:10	0:20	2	Organisation of work and adoption of the agenda	
9:30	0:45	4	Review of decisions of the XI-th Meeting of the WMO-Commission for Hydrology relevant to the activities of the GRDC	
10:15	0:20		<i>recreational break</i>	
10:35	0:30	5	Brief outline of GRDC's history and mile stones	H.-J. Liebscher
11:05	0:40	6	Recapitulation of the vision statement and implementation goals developed during the 4th SC meeting	
11:45	1:30		<i>lunch break</i>	
		7	Summary report of GRDC activities, status and developments	
13:15	0:10	7.1	Data acquisition	M. Hils
13:25	0:10	7.2	Data dissemination and use	J. Pauler
13:35	0:15	7.3	Development of the database management system	T. DeCouet
13:50	0:15	7.4	Development of geographic information system application	
14:05	0:10	7.5	Data products	I. Dornblut
14:15	0:10	7.6	GRDC reports	
14:25	0:10	7.7	Homepage and public relations	
14:35	0:10	7.8	Collaborations and co-operations	
14:45	0:20		<i>recreational break</i>	
		8	Status and activities of GRDC co-operations in UN-Programmes	
		8.1	World Climate Research Program (WCRP)	
15:05	0:30	8.1.1	GEWEX: GHP, CEOP-I, ISLSCP-II	W. Fröhlich
15:35	0:10	8.1.2	ACSYS/CLIC	
15:45	0:30	8.2	WHYCOS	
16:15	0:15	3	GRDC at the Federal Institute of Hydrology: review and perspectives for development	V. Wetzel
16:30			<i>meeting adjourns</i>	
17:30	5:00		Common dinner in the cosy "Alte Mühle" (Old Mill)-cellar restaurant 30 km upstream the Mosel River	
22:00			<i>approx. back in Koblenz</i>	

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

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Provisional Agenda (Status 15 June 2001)

<i>time</i>	<i>duration</i>	<i>item</i>	<i>topic</i>	<i>contributions from</i>
Tuesday 26 June 2001				
9:00	0:30	8.3	GCOS/GTOS	
9:30	0:30	8.4	GTN-H (Global Terrestrial Network for Hydrology)	
		8.5	UNESCO/IHP	
10:00	0:30	8.5.1	FRIEND	NN
10:30	0:20		<i>recreational break</i>	
10:50	0:20	8.5.2	HELP	NN
11:10	0:20	8.6	WWAP/WWDR	T. Jimbo
		8.7	Global data centres	
11:30	0:40	8.7.1	GEMS/Water (UNEP + WMO)	A. Fraser
12:10	1:30		<i>lunch break</i>	
13:40	0:40	8.7.2	GPCC (WMO)	B. Rudolf
14:20	0:40	8.7.3	IGRAC (International Groundwater Assessment Centre)	J.-A. Boswinkel
		9	Other Collaborations	
15:00	0:15	9.1	University of New Hampshire, United States	
15:15	0:15	9.2	University of Kassel, Germany	
15:30	0:20		<i>recreational break</i>	
15:50	0:20	9.3	European Flood Forecasting System (EFFS)	W. Fröhlich
16:10	0:15	9.4	United States Geological Survey	
16:25	0:20	9.5	Model Parameter Estimation Experiment (MOPEX), United States	
16:45	0:15	9.6	GLOBWINET – co-operation in an Associated Programme (AP) of the Global Water Partnership (GWP)	
17:00			<i>meeting adjourns</i>	

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

Provisional Agenda (Status 15 June 2001)

<i>time</i>	<i>duration</i>	<i>item</i>	<i>topic</i>	<i>contributions from</i>
Wednesday 27 June 2001				
		10	Metadata and databases	
9:00	1:00	10.1	Current activities, actual developments related to meta-databases and implications	
10:00	0:20	10.2	Rescue of evaporation data (WMO)	
10:20	0:20	10.3	Database on soil moisture	
10:40	0:20		<i>recreational break</i>	
11:00	0:20	10.4	Lakes and Reservoirs (ICOLD, ILEC)	
11:20	0:40	11	Review of GRDC collection criteria for discharge stations	
12:00	1:30		<i>lunch break</i>	
13:30	1:00	12	Quality assessment and quality control of GRDC data	
14:30	0:20		<i>recreational break</i>	
14:50	0:40	13	Review of GRDC data acquisition strategy	
15:30	0:40	14	Re-iteration of the long term strategic development of GRDC	
16:10			<i>meeting adjourns</i>	
16:45	1:45		Guided tour and sparkling-wine tasting in the Deinhard cellars, a traditional company in the heart of Koblenz	
18:30			<i>approx. end of tour</i>	
Thursday 28 June 2001				
		15	Review of GRDC policy for the acquisition and dissemination of data	
9:00	0:20	15.1	Overview of internationally applied data policies	
9:20	0:20	15.2	Proposal	
9:40	0:50	16	Future GRDC activities - discussion of work plan and priority list	
10:30	0:20		<i>recreational break</i>	
10:50	0:30	17	Review of membership of the Steering Committee	
11:20	0:20	18	Election of the new chairman	
11:40	0:10	19	Date and venue of next meeting	
11:50	0:10	20	Closure of meeting	
12:00			<i>end of meeting</i>	

Annex 2

**Annotations to the provisional agenda of
the meeting (including an Executive
Summary Report of GRDC activities,
status and developments)**

5th Meeting of the GRDC Steering Committee

Koblenz, 25 – 28 June 2001

Annotations to the provisional agenda

Status: 24 June 2001

Monday, 25 June 2001

1 Opening of the meeting by the chairman and the president of BfG

Following brief greeting by the president of BfG and introductory comments, the 5th meeting of GRDC-SC will be formally opened by the chairman of the GRDC Steering Committee, Prof. H.-J. Liebscher.

2 Organisation of work and adoption of the agenda

The provisional agenda will be discussed, necessary changes made and the final agenda adopted by participants.

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

The Federal Institute of Hydrology (BfG) provides the core funding of GRDC on behalf of Germany's commitment to host the GRDC. Funding includes staff salaries, provision of office space and office infrastructure as well as data processing facilities and support of travel of GRDC staff. The presentation will highlight on the support structure and facilities of BfG and future perspectives of further development from the view of BfG.

The SC may wish to comment on the presentation made and provide feed-back to BfG on the past, present and future support of GRDC activities.

4 Review of decisions of the XIth Meeting of the WMO-Commission for Hydrology relevant to the activities of the GRDC

The WMO Commission for Hydrology held its eleventh session from 6-16 November 2000 in Abuja, Nigeria. A number of CHy agenda items are more or less directly linked to the work of GRDC and should be reiterated to have them in mind in the remaining discussions. (cf. annex).

Under this agenda item we also expect to hear about GRDC-relevant news from the **Fifty-third session of the WMO Executive Council** held in the WMO Secretariat in Geneva from 5-15 June 2001.

5 Brief outline of GRDC's history and mile stones

A general overview of GRDC history and its development will be supplied to participants during the meeting by the resigning chairman Prof. Dr. Hans-Jürgen Liebscher.

6 Recapitulation of the vision statement and implementation goals developed during the 4th SC meeting

At the previous SC the participants developed a "Vision-Statement" for the strategic outreach of the GRDC and from that derived implementation goals. The SC will be briefed again about these goals to have them in mind when discussing the remaining agenda items, notably item 14 and 15.

7 Summary report of GRDC activities, status and developments

7.1 Data acquisition

The GRDC database was actualised during 1999 with river discharge data from the following regions (number of stations): Canada (>400), U.K. (16), Ukraine (2), Sweden (18), Mexico (7), Russian Federation (69), Cote d'Ivoire (4), Norway (15), Austria (5), Portugal (10), Poland (12), Danube river basin (12).

During 2000 the GRDC database was actualised with river discharge data from the following regions (number of stations): Russia (1530), Basin of Mackenzie (369), Basin of Yukon (50), USA (326), Sweden (7).

The database now comprises 2533 stations featuring 70.000 station years of daily data (25 million data points) and 5621 stations featuring 160.000 station years of monthly data (1.9 million data points). Further information on the database will be provided to the SC during the meeting.

In November 2000 the occasion of the quadrennial WMO meeting of the Commission of Hydrology (CHy) in Abuja, Nigeria, was used to personally present individual country reports on the data situation of totally 35 countries to the respective representatives in order to foster their commitment to contribute data.

7.2 Data dissemination and use

The number of enquiries to GRDC decreased during 1999. About 170 downloads of GRDC databank catalogues were registered in the homepage, from which a total of 47 applications were processed for data and requests of related information.

In 2000 the number of enquiries to GRDC developed non-uniformly. While there has been an increase to approximately 500 download requests from the GRDC homepage (+200 %) the number of written requests decreased to 37 (-21 %) during 2000. This presumably reflects the improved and extended offer of derived data products on the GRDC homepage.

7.3 Development of the database management system

A database requires continued development to enlarge the capabilities of information retrieval and to take into account the ever ongoing development of soft- and hardware environments. The major achievements during the last two years were:

- Improvement of the tool for station-wise plausibility check and its extension to produce data sheets of station's summary statistics.
- Redesign and extension of the catalogue tool for easy exploration of the GRDC meta-database.

- Improvement and extension of the database concept and structure, i.e. elimination of redundancies, addition of extra information as the spatial relation of stations (upstream, downstream), storage of waterlevel-discharge relations etc.
- Improved linkage between database and GIS.

7.4 Development of geographic information system application

GIS-tools were developed and tested for computation and visualisation of catchments and location of discharge gauge-stations. The developments are based on a USGS version of a global digital elevation model (DEM) called HYDRO-1k-Data set (resolution 30'') and a much coarser data set (0.5°) provided by GRDC's cooperation partner University of Kassel. Both data sets provide for flow directions, flow networks, and accumulations grids. Tests on computed catchment areas showed significant differences when compared with the registered stations' metadata. Further details will be reported during the SC.

7.5 Data products

Two data products based on GRDC discharge data are available through the internet homepage since early 1999: a) monthly values of river discharge for 1,352 stations with both records lengths longer than 10 years and catchment area larger than 2,500 km², and b) monthly values of river discharge for 181 stations located close to the world oceans and big lakes, with a catchment area larger than 5,000 km².

7.6 GRDC reports

The following GRDC reports have been published since the fifth SC:

- No. 24, Use of GRDC Data 1993 – 1999 : A Comprehensive Summary
- No. 25: GIS-related Monthly Balance of Water Availability and Demand in Large River Basins - Case Study for the River Danube / Irina Dornblut.
Details about this work will be presented during the meeting by the author.
- No. 26: Modelling raster-based monthly water balance components for Europe / Carmen Ulmen

Two further reports are in preparation, one summarising report of the current situation with respect to online available discharge and water stage information and an updated edition of report number 10: Freshwater fluxes to the oceans. A total of 250 stations with catchment areas larger than 25.000 km² will be considered, i.e. a significantly improved database as compared to earlier issues.

7.7 Homepage and public relations

Emphasis has been put on the improvement of the GRDC homepage which now also provides downloadable GRDC-reports in PDF-format. Smaller changes include an improved catalogue tool and a stronger commitment to ensure the topicality of GRDC homepage as it is visible from the "What's new" section. However, these improvements can be viewed only as forerunners of a major redesign, which is currently in its conceptual phase. GRDC has been present at various occasions on international meetings most notably the WWF 2 in The Hague and the CHy meeting in Abuja, Nigeria. Currently, GRDC heads for a display area at the International Conference on Freshwater to be held in Bonn from 3-7 December 2001. A new, more modern version of the GRDC flyer with minor changes is planned. SC is requested on make its suggestions towards the redesign.

7.8 Collaborations and co-operations

Though there have been significant changes in the personnel of GRDC during the last two years, GRDC has by and large succeeded to keep track of its commitments in its various collaborations and co-operations as explained in detail in agenda item 8 and 9.

8 Status and activities of GRDC co-operations in UN-Programmes

8.1 World Climate Research Program (WCRP)

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

GRDC collaborates with the International Satellite Land Surface Climatology Project, Initiative II (ISLSCP-II) within the Global Energy and Water Cycle Experiment (GEWEX), where the GRDC will contribute with discharge data to a comprehensive data collection for the 10 year period from 1986-1995 in the course of the year 2001.

GRDC participates also within a GEWEX initiative called CEOP-I (Coordinated Enhanced Observation Period) 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 (Amazonas), GCIP (Mississippi), GAME (three regions in Asia).

8.1.2 ACSYS/CLIC

GRDC contributes to the Arctic Climate System Study (ACSYS) with the compilation of the Arctic Runoff Data Base (ARDB). During 2000, GRDC succeeded to include a large number of stations and data from the territories of the former Soviet Union. A recent meeting with V. Vuglinsky from the State Hydrological Institute in St. Petersburg revealed the possibility to obtain an update of around 50-100 stations later this year.

8.2 WHYCOS

SC will be briefed about the current status of WHYCOS projects and the state of development of already funded WHYCOS projects such as Med-HYCOS in the Mediterranean region and SADC-HYCOS in countries of southern Africa. Further development of HYCOS sub-projects and the envisaged mechanism to link these regional HYCOS-projects into WHYCOS should be discussed.

SC is requested to discuss its view of the links between WHYCOS and GRDC, to intensify communication and consultation between these two major data collection initiatives of the OHP of WMO. The discussion of collaborative activities of GRDC with regional HYCOS projects should include issues of station selection and the exchange of data between HYCOS and GRDC.

Tuesday, 26 June 2001

8.3 G3OS (GTOS, GCOS, GOOS) and IGOS

G3OS: Global 3 Observing Systems (GCOS, GOOS, GTOS)

IGOS: Integrated Global Observing Strategy

In order to ensure a continuing close synergy and enhanced information exchange among the **Global Climate Observing System (GCOS)**, the **Global Ocean Observing System**

(GOOS), and the **Global Terrestrial Observing System (GTOS)**, and to develop a common strategy toward their implementation and their application, the sponsors, FAO, ICSU, UNEP, UNESCO and its IOC, and WMO, together with representatives of the respective observing programmes (head of support/planning offices), agree to meet as a Sponsors Group for the Global Observing Systems (GCOS, GOOS and GTOS) with the following objectives:

- To review the observational requirements as defined by the users communities and to advise and recommend on harmonisation of medium and long-range strategies of the three observing programmes;
- To consider the actual and potential capacities of the three Observing Systems to meet the requirements, identify gaps and overlaps, and make proposals as appropriate to improve coverage and efficiency;
- To advise on existing and potential joint activities between the three programmes, review the means established to achieve cooperation through such joint activities, and make recommendations to enhance coordination;
- To identify areas where existing research and operational observing programmes of the sponsors contribute to meeting the objectives of the three Observing Systems, and to assist in facilitating such contributions;
- To assist on information exchange, public and media relations and fund-raising;
- To examine the mechanisms established or proposed at the regional and national level to participate in or support the three observing programmes, and to encourage and support approaches that will increase national benefits and contributions globally, with particular attention to developing countries;
- To review and make recommendations concerning the mechanisms established or proposed to coordinate the three observing programmes with relevant international bodies and programmes;
- To review and make recommendations on data management through the programmes with the objective of the widest possible data exchange and dissemination;
- To advise on activities to facilitate the use and application of the data from the Observing Systems with particular attention to developing countries.

The **Integrated Global Observing Strategy (IGOS)** seeks to unite the major satellite and surface-based systems for global environmental observations of the atmosphere, oceans and land.

GRDC had been invited to participate in a meeting on the development of a **Water Cycle Theme** in response to an invitation to do so by the partners of IGOS. The meeting was held in Los Angeles 8-10 January 2001 and organised by the WCRP. The SC may wish to exchange their views of this activities.

8.4 GTN-H (Global Terrestrial Network for Hydrology)

GTN-H is a recently started initiative of several agencies and programmes to establish a Global Terrestrial Network for Hydrology (GTN-H) of near real time data of 10 hydrological variables.

An **Expert Meeting on the Implementation of a Global Terrestrial Network - Hydrology (GTN-H)** was held from **21 to 22 June 2001** at the Global Runoff Data Centre (GRDC). The single most important deliverable of the meeting is the formal establishment of GTN-H with a complete definition of its functions, operation, coordination and communication mechanism between network partners, scientists and other users of the network within the

framework of its goals and principal deliverables established during the first meeting on the “Establishment of a hydrological network for climate” in Geisenheim, Germany in June 2000.

As a start for its contribution GRDC is currently compiling an overview of available online river stage and runoff data in the world wide web in order to eventually develop a system which allows to comfortably overview online available data on streamflow.

GRDC is currently researching online available discharge and water level information which it intends to summarise in a GRDC Report pointing out its various aspects of heterogeneity. The idea behind this is, that in order to find a start, GRDC heads to somehow kick-off an concrete integration initiative, i.e. GRDC should start to develop a prototype system, which seeks to integrate what currently is "easily" available. The prototype then could serve - though by no means complete – as "something to show", thus hopefully helping to convince others to join the initiative, i.e. acting as a catalyst and incentive.

A procedure favoured by GRDC would be to first distributed the above mentioned GRDC report to those already providing data by the internet (15-20 countries or regions). Then, a meeting could be arranged (who could fund it?) to bring them together and somehow compromise on a common denominator in order to finally step by step establish a concrete plan how to develop a prototype of an integrated information system (e.g. on base of simple and robust transfer of ASCII-files by FTP or - more sophisticated - using XML). The most difficult task in GTN-H will be to motivate the individual contributors and make them to contribute the required resources and commitment to the project.

In this context it may be of interest to know that GRDC is involved in a EU research project entitled "European Flood Forecasting System (EFFS)" (<http://effs.wldelft.nl/>) where GRDC's part is to collect the necessary online discharge data in an automated mode. So far a first prototype application has been developed with FIH-funds, which imports data (that must conform to agreed standards) from FTP sites, summarises it and exports it in an unified fashion for other participants in the project. This tool will be the nucleus for an application used within GRDC's GTN-H-contribution.

8.5 UNESCO/IHP

8.5.1 FRIEND

GRDC supports the data acquisition for some central European countries of the North European component of the UNESCO/IHP Programme “Flow Regimes from International Experimental and Network Data Sets” (NE-FRIEND).

A current progress report on FRIEND (approx. 30 pp) has been made available and will be circulated during the SC meeting. The SC is invited to exchange its views on FRIEND with respect to GRDC.

8.5.2 HELP

HELP (Hydrology for the Environment, Life and Policy) is a joint UNESCO/WMO programme which is designed to establish a global network of catchments to improve the links between hydrology and the needs of society. It is a cross-cutting programme of the UNESCO International Hydrological Programme and will contribute to the World Freshwater Assessment Programme, and the Hydrology and Water Resources Programme of WMO.

The vital importance of water in sustaining human and environmental health is the key driving force behind HELP. However, no international hydrological programme has addressed key water resource issues in the field and integrated them with policy and management needs. HELP will change this by creating a new approach to integrated catchment management. The new approach is to use real catchments, with real water related problems as the environment within which hydrological scientists, water resources managers and water law and policy experts can be brought together.

HELP is therefore a **problem-driven** and **demand-responsive** initiative that will focus on the following eight key issues:

- Water and food security
- Water quality and human health
- Water and the environment (environmental health)
- Water and potential conflicts
- Impact of climate variability on water resources
- Improved communications between hydrologists and society
- Water-related disaster prevention and mitigation (flood control, drought management)
- Water for socio-economic development

The outputs of HELP will be new data and models which are more suitable for the revision of current water policy and water resources management practices in all of the above eight areas.

A current draft status report on HELP (approx. 8 pp) has been made available by UNESCO and will be displayed during the SC meeting. SC is requested to discuss HELP and its possible links to GRDC's tasks.

8.6 WWAP/WWDR

The World Water Development Report (WWDR) will be a periodic review, continuously updated, designed to give an authoritative picture of the state of the world's freshwater resources and our stewardship of them. The WWDR will be the major component of the UN World Water Assessment Programme. It will contain indicators and analysis that will identify, diagnose and assess:

- The effectiveness of societal stewardship of global freshwater resources including the broad institutional and socio-economic context of water resource utilisation;
- The supply, demand and uses for water and the challenges of extreme events;
- Current critical problems and emerging threats to freshwater ecosystems and their management;

The WWDR will consist of three parts:

Volume I: The Current State of Global Water Stewardship: This volume will contain the results of the three-component analysis (assessments of human water stewardship, the state of the resource and of critical problems), presented in the context of 'Progress in Implementation of Chapter 18 of Agenda 21'. It will be an accessible narrative report on the global water situation with key maps, graphics and tables.

Volume II: Methodology: This volume will provide the background to Volume 1. It will document the emerging WWDR methodological approach, from data through analysis to the production of indicators of water-related stress.

Volume III: Case Studies: Detailed reports on a small number of case studies.

GRDC has offered to contribute to the report, first of all by its data, but also by application of the WABAL methodology (cf. agenda item 7.6) in the context of case studies requested for volume III.

GRDC has participated in two recent workshops on “Models and Modeling” in Colombo, Sri Lanka, in December 2000 and on “Data and Databases” in Geneva, Switzerland, in January 2001.

SC is requested to discuss WWDR and its views on GRDC’s involvement in this task.

8.7 Global data centres

8.7.1 GEMS/Water Collaborating Centre (GWCC)

The Global Environment Monitoring System - Water (GEMS-Water) Programme of UNEP and WHO is a multi-faceted water science programme oriented towards understanding freshwater quality issues throughout the world. Major activities include **monitoring, assessment, and capacity** building. The implementation of the GEMS/Water programme involves several United Nations agencies active in the water sector as well as a number of organisations around the world.

Recently a independent expert review of the GEMS/Water Programme was initiated by UNEP, and a draft report compiled after a Review Workshop in Nairobi, Kenya, 22-23 May 2001. SC will be briefed about new developments at GWCC and is invited to comment on future joint activities as part of the development strategy of both, GRDC and GWCC.

8.7.2 GPCC (WMO)

GPCC and GRDC are considered key global databases for GEWEX. Both centres are members of the GEWEX Hydrometeorological Panel (GHP) and provide inputs to GEWEX Global Scale Experiments and modelling efforts. The availability of precipitation information on a 30 minute grid and a simulated river network with 30 minute resolution obtained from the collaborative effort of GRDC with the University of New Hampshire open a new window of opportunity for cooperation. Likewise, GPCC data are used for the application of a Water Balance Model for Europe which is completed and presented in GRDC-Report 26.

SC will be briefed about new developments at GPCC and is invited to comment on future joint activities as part of the development strategy of both, GRDC and GPCC.

8.7.3 IGRAC (International Groundwater Resources Assessment Centre)

A representative from The Netherlands will comment on the progress which has been made with a proposal to establish the International Groundwater Resources Assessment Centre (IGRAC) in The Netherlands. After the Fourteenth International Council of the IHP of UNESCO had passed a resolution on IGRAC in June 2000, CHy-XI, which convened in Abuja, Nigeria, 6-18 November 2000, adopted Recommendation 1 concerning the establishment of IGRAC in November 2001.

9 Other Collaborations

9.1 University of New Hampshire, United States

GRDC cooperated with the Complex Systems Research Center at the Institute for the Study of Earth, Ocean and Space of the University of New Hampshire, to produce the gridded “**Global Composite Runoff Fields on Observed River Discharge and Simulated Water Balances**” to estimate the long-term averaged monthly runoff. The results are reported in GRDC-Report 22.

In an ongoing collaboration GRDC and UNH produce their next joint product, a time series of composite runoff fields covering the time period (1986-95) for the **ISLSCP II** initiative (cf. 8.1.1).

GRDC also is pleased to be invited (as GPCC) to participate in the proposal of a project entitled “**Global Rapid Integrated Monitoring System for Terrestrial Water Cycle and Water Resource Assessment (Global-RIMS)**” proposed to NASA as a response to their recent Research Announcement (NRA-00-OES-07). This project is a natural extension of current work in the development and dissemination of high quality runoff datasets at the global scale. The intended system will combine state-of-the-art hydrographic monitoring techniques and knowledge of the distributions of human population and water-dependent infrastructure. A set of retrospective and operational hydrographic and water scarcity index data sets will be produced and distributed. The expertise, hydrologic analysis tools, and observational time series already are in place for the proposal research team to create a Global-RIMS. From ongoing work, UNH is prepared to routinely assimilate and merge NWP, remotely-sensed precipitation, and observed discharges to produce consistent, mass-conserving global data sets depicting the terrestrial water cycle. UNH also has developed or has access to high resolution mapping of rural and urban population, water infrastructure, and water use statistics.

The development of semi real-time composite data products as outlined in the Global-RIMS proposal is an exciting new opportunity for us to offer value added products derived from our data holdings.

This project will perfectly combine to GRDC’s and UNH’s commitment in the framework of **GTN-H** to foster the aggregation and integration of online available discharge data as outlined under agenda item 8.4.

9.2 University of Kassel, Germany

The **Center for Environmental Systems Research** at the University of Kassel is developing a global model of runoff, water availability and water use in drainage basins, **WaterGAP (Water - Global Assessment and Prognosis)**. The spatial resolution of the model is 0.5°, with each cell being part of a drainage basin, a country and a world region. The purpose of the model is to assess the impact of global change on water scarcity and floods. Global change here refers to climatic change as well as to demographic, economic and technological change. Used for quantitative scenario analysis, WaterGAP will help to identify appropriate water management measures.

With results from of WaterGAP 1, CESR contributed to the Annual Report 1997: World in Transition: Ways Towards Sustainable Management of Freshwater Resources by the German Advisory Council on Global Change (WBGU).

At the CESR, an improved version of WaterGAP, WaterGAP 2 has been developed. Different from WaterGAP 1, the hydrological module includes not only a vertical water balance but also lateral routing. Besides, the representation of lakes, reservoirs and wetlands is highly improved. In order to be able to simulate river discharge in a realistic manner, it was necessary to calibrate the hydrological model against time series of observed discharge.

In this framework GRDC provided discharge data of approximately **1100 stations** to CESR. In return CESR agreed to deliver their local **drainage direction map (resolution 0.5° by 0.5°)**, which was considerably improved by manual comparison of automated generated results with available mapped information.

With the calibrated model, CESR will assess the impact of climate change on discharge at the stations and make this information available to GRDC.

9.3 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. This system provides daily information on potential floods for large rivers such as the rivers Rhine and Oder as well as flash floods in small basins. This flood forecasting system can be used as a pre-warning system to water-authorities that already have a 0-3 day forecasting system. The system can also provide flood warnings for catchments that at present do not have a forecasting system (Eastern-European countries). The framework of the system will allow incorporation of both detailed models for specific basins as well as a broad scale model for entire Europe. Once designed, the prototype will be tested and evaluated for several months. Together with end-users, channels to disseminate the forecasts and their uncertainties will be developed

The **main objectives** of the project are:

- To take advantage of currently available Medium-Range Weather Forecasts (4 - 10 days) to produce reliable flood warnings beyond the current flood warning period of approximately 3 days.
- To design a Medium-Range Flood Forecasting System for Europe that will produce flood warnings on the basis of the Medium Range Weather Forecasts.
- To produce flood forecasts in regions where at present no flood forecasts are made on the basis of the newly developed system.

The EFFS project has 11 cooperating European partners. The **tasks of the GRDC** comprise the networking of data providers, project partners and users, the collection, processing, archiving of hydrological data; the dissemination of data for forecasting purposes and the organisation and co-ordination of data acquisition, transmission and use for flood forecast for operational purposes.

The GRDC plays the role of the hydrological data provider for the project. They will use their network to assist and advise other partners to collect hydrological data from other data base

providers if these data are not in the data base of GRDC. In this regard, the EFFS project can be viewed as a prototype for GRDC's commitment to contribute to the GTN-H network (cf. agenda item 8.4).

9.4 United States Geological Survey

GRDC maintains close links to the USGS, one of the few services which sends updates of discharge data on a regular basis (Dr Steve William, also GHP Data Management Subcommittee). GRDC also is in contact with the team which developed the National Water Information System (NWIS) <<http://water.usgs.gov/nwis>> and on top of this the visualisation tool called Water Watch <<http://water.usgs.gov/waterwatch>> (Dr Harry Lins). This contact will be especially helpful with respect to the development of a similar tool for the world in the framework of GTN-H (cf. agenda item 8.4).

9.5 Model Parameter Estimation Experiment (MOPEX), United States

A basic step in modelling hydrologic processes is to estimate model parameters that vary spatially and are unique to each grid point. Improved methods for parameter estimation (especially for parameters important to runoff response) are needed. To develop these methods, data from a wide range of climate regimes throughout the world must be assembled and used with different hydrologic models. This requires an international effort which is called the **Model Parameter Estimation Experiment (MOPEX)**.

A high priority of MOPEX is to assemble historical hydrometeorological data and river basin characteristics for about 200 intermediate scale river basins (500 - 10 000 km²) from a range of climates throughout the world. The data sets to be developed would not be model specific and would be appropriate for developing parameter estimation schemes for most, if not all, hydrologic models land surface parameterisation schemes of atmospheric models. These data are freely available through a web site to the scientific community both for MOPEX research as well as for other global hydrological research.

Potentially useful data for the MOPEX project include daily and monthly streamflow data for drainage areas ranging from about 1000 sq. km. to about 50,000 sq. km. Basins smaller than 1000 sq km generally do not have a dense enough network of precipitation gages to get sufficiently accurate estimates of basin average precipitation. Basins larger than about 50,000 sq km have a greater likelihood of significant upstream regulation and tend to be too large to model using lumped hydrologic models for the entire basin. The period of record needed is at least 10 years.

During a meeting at GRDC's office with John Schaake of the US National Oceanic and Atmospheric Administration (NOAA), it appeared as if there may be as many as several hundred GRDC stations the basins of which could meet these MOPEX criteria, especially for monthly data but many daily stations seemed to be available as well.

The GRDC will provide the desired streamflow data to scientists participating in MOPEX. The procedure will be for each scientist to get the streamflow data directly from the GRDC. The MOPEX web site will provide appropriate guidance for scientists to get streamflow data from GRDC.

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

GLOBWINET is one of the Associated Programmes of the Global Water Partnership (GWP). It is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by the German Agency for Technical Cooperation (GTZ).

GLOBWINET aims to provide an information platform for integrated water resources management. Basically it is planned as 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 and can be accessed either by these objects, by main categories or by search among the automatically assigned keywords, using thesauri techniques. Right now the South African component SAWINET and the German component GEWINET are under development. GRDC has got a contract to assist GTZ in stimulating the German administration to fill GEWINET with actual information about German Water Resources Management. Further information is available from <http://www.globwinet.org> + http://www.waterweb.org/wis/wis3/presentations/39_Meier.pdf.

Wednesday, 27 June 2001

10 Metadata and databases

10.1 Current activities, actual developments related to meta-databases and implications

The necessity of metadatabases is an issue of exponentially growing interest and of rising awareness. In the water community, such topics have been discussed e.g. during the consultative WMO/UNESCO meeting in Paris in February 1999 and a first informal meeting on this subject was held in March 1999 in Koblenz with the concerned agencies and representatives of databases and water programs.

GRDC was recommended by the 4th SC to develop a metadata template and implement it in the GRDC catalogue system. Under agenda item 11.8.2 of last years CHy-X meeting, GRDC was further requested to consider setting up a global meta-database, starting with 200 discharge stations on major rivers flowing to the oceans. The goal should be the set-up of an internet-based metadata information system (physical and topographic features of basins, land use and hydrology.)

GRDC has performed some initial research in the feasibility of the plan to develop its own metadatabase on river basin related informations, the results of which will be made available during the SC meeting. SC may wish to recommend appropriate actions on the side of the GRDC.

10.2 Rescue of evaporation data (WMO)

As was pointed out at the 4th SC, data on evaporation is not collected in a global database. On the basis of decisions of the 3rd GRDC-SC meeting, WMO has made an inquiry about the availability of evaporation data amongst members of WMO with a positive response. When the inquiry phase has been completed, WMO/GRDC will contact the sources of data directly to collect evaporation data for inclusion in a separate global database.

10.3 Lakes and Reservoirs (ICOLD, ILEC)

The previous SC discussed this item in some length and recommended that a global database on lakes and reservoirs is required, linking the GRDC database and the GEMS/Water database. A detailed proposal for the establishment of such a database should be discussed inter alia with ICOLD, ILEC, GRDC and GEMS/Water. SC proposed that GRDC and GEMS/Water should lead the discussion initially.

However, in the meantime there exists a draft proposal of the State Hydrological Institute of St. Petersburg on the establishment of an international centre of data on hydrology of lakes and reservoirs.

11 Review of GRDC collection criteria for discharge stations

General criteria for data collection are: Data should be collected for rivers which reflect the hydrological regime of a region or part of a country, rivers which are economically important in terms of population density and/or agro-based or industrial production and those rivers which drain into the oceans or have an internal drainage. The collection programme from discharge stations can be categorised into three classes:

- **Baseline Stations**, representing relatively small basins with natural flow conditions serve as reference stations for natural or quasi-natural hydrological regimes.
- **Trend stations**, with decades of discharge data available to detect trends in streamflow as a result of climate variability or change.
- **Flux stations**, which are all situated at the mouth of rivers into the oceans to calculate the continental freshwater runoff into the oceans.

Preferably mean daily discharge data of good quality and long time series of discharge are favoured for entry into the database.

12 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. The SC also noted the considerable efforts made by GRDC in the past years to perform a plausibility control of dubious data. The co-operation of data providers in both efforts is indispensable.

In this matter there has been some correspondence between GRDC and Paul Pilon of Environment Canada, who was one of the major advocates for this kind of meeting. The

correspondence is provided in the annexes. SC is invited to reflect on the ideas expressed in the correspondence.

13 Review of GRDC data acquisition strategy

14 Re-iteration of the long term strategic development of GRDC

Under this agenda item it is intended to resume agenda item 6 in the light of the discussions of the last three days and amalgamate them to a possibly revised set of visions and actions for the GRDC.

15 Review of GRDC policy for the acquisition and dissemination of data

15.1 Overview of internationally applied data policies

15.2 Proposal

GRDC likes to propose to categorise all GRDC data in different classes of accessibility in order to provide for the possibility to publish such data which has been put online or released in other formats, e.g. yearbooks, by their respective producers. Furthermore the question is raised how the GRDC intends to enforce the policy. A comment on this question might be reasonable to be included in the “**Policy Guidelines for the Dissemination of Data and Costing of Services**”.

Thursday, 28 June 2001

16 Future GRDC activities - discussion of work plan and priority list

In the view of the fact, that present staff of GRDC consists of 4 full-time permanent staff and three part-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.

17 Review of membership of the Steering Committee

Besides the chairman and the secretary to the SC the SC consists of three types of members, namely **Institutional members**, **Non-institutional members** and **Observers, invited experts and governmental/non-governmental institutions**. The composition of the SC will be discussed and should be adjusted.

18 Election of the new chairman

The present chairman, Prof. Dr. Hans-Jürgen Liebscher, has retired from his long lasting service for the German Federal Institute of Hydrology in May 2001. He therefore intends to also resign from his function in the GRDC SC, thus SC will have to elect a successor for the position of the chairman.

19 Date and venue of next meeting

SC may consider the date of the next meeting in June 2003. Having had the SC meeting for the fifth time in Koblenz, SC is invited to think of feasible alternatives for the 6th meeting of GRDC-SC.

20 Closure of meeting

Annex 3

**Membership of the Steering Committee by
organisations or group**

Membership of the Steering Committee by organisations or group

5th GRDC Steering Committee Meeting,
25 – 28 June 2001, Koblenz, Germany

WMO	World Meteorological Organization
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
WHO	World Health Organization
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
Developing Country: Africa	Developing Country
Director BfG	Director of the Federal Institute of Hydrology, host of GRDC
BfG	Bundesanstalt für Gewässerkunde (Federal Institute of Hydrology)
German IHP/OHP Secret.	German Secretariat of the International Hydrological Programme of UNESCO (IHP) and of the Operational Hydrological Programme of WMO (OHP)

List of invitees (gray: attendees)

WMO	Askew	Arthur	
	cc Grabs	Wolfgang	
UNESCO	Szöllösi-Nagy	Andras	Sent: WWAP Jimbo, Takeo
	cc Bonell	Mike	
UNEP	Diop	Salif	
WHO	Helmer	Richard	
ICSU/IAHS	Hubert	Pierre	
GPCC	Rudolf	Bruno	
GEMS/Water	Robarts	Richard	
	cc Fraser	Andrew	
IGRAC	Boswinkel	Jan-Anne	
FRIEND	Gustard	Alan	
WCRP	Carson	David	
	Savtchenko	Victor	
CHy	Rutashobyia	D.G.	
	cc Hofius	Karl	
	cc Pilon	Paul	
	cc Kaneki	Makoto	
	cc Wellens-Mensah	Julius	
Government of Japan	Kinosita	Takeo	
	Nakao	Tadahiko	
Developing Country: Africa	Wellens-Mensah	Julius	
Director BfG	Wetzel	Volkhard	
BfG	Liebscher	Hans-Jürgen	
	Wilke	Klaus	
German IHP/OHP Secret.	Hofius	Karl	

Annex 4

List of attendees

List of attendees

5th GRDC Steering Committee Meeting,
25 – 28 June 2001, Koblenz, Germany

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Annex 5

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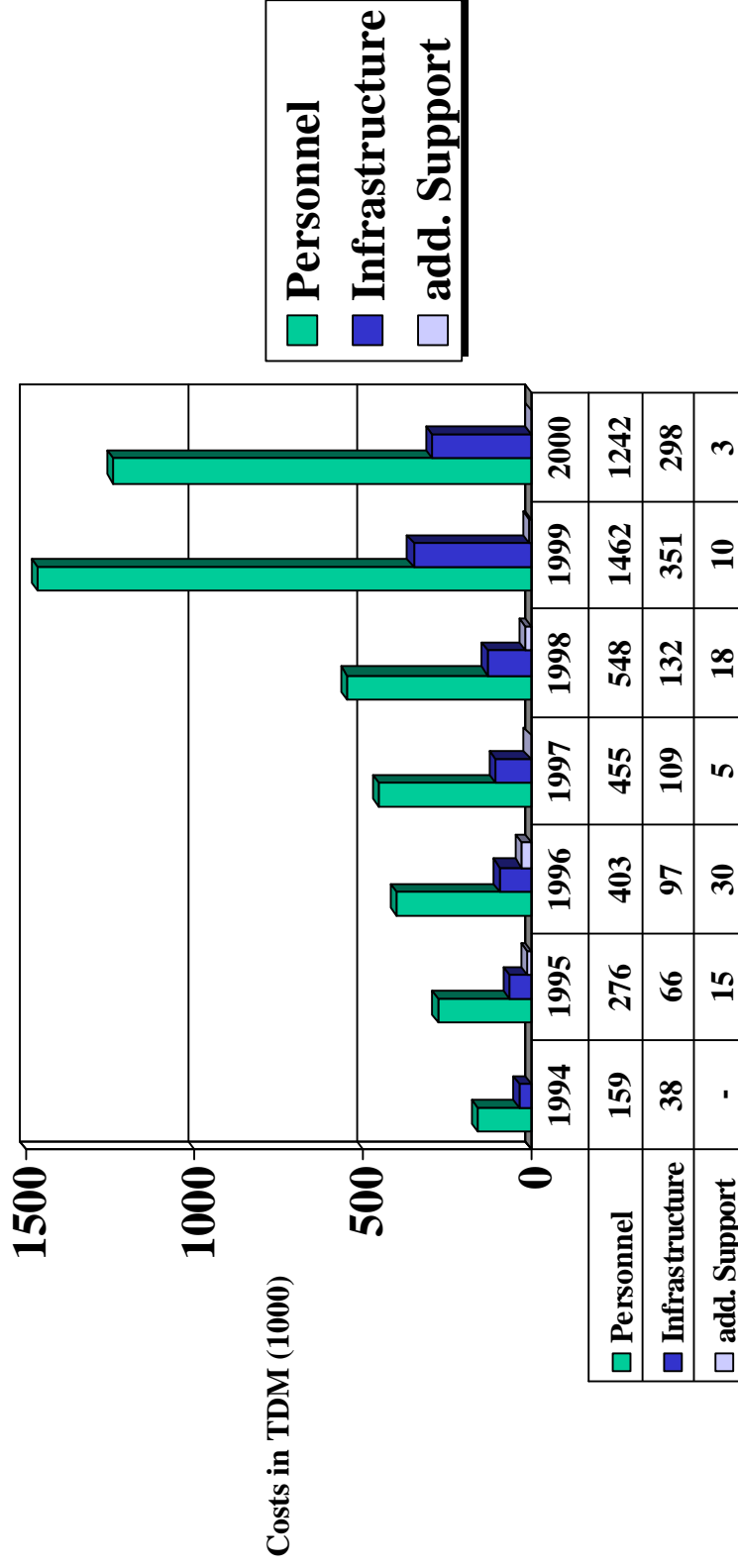
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Annex 6

GRDC's financial resources

Personnel, infrastructure and additional support by BfG for GRDC



Source: Programmbudget BfG



Annex 7

**GRDC's history and mile stones:
summary of the presentation of
Prof. Liebscher**

Historical development of Global Runoff Data Centre (GRDC)

- 1980: 1st planning meeting of WCAP-Water in Geneva, projects A.2 (Analysing long time series of hydrological data and indices with respect to climate variability and change) and A.5 (Collection of global runoff data sets) were created
- 1982: Data request of FGGE-data by WMO for the years 1978-1980
- 1982: 2nd planning meeting of WCP-Water in Paris
- 1984: Start of data-collection at the Institute for Bioclimatology and applied Meteorology of University of Munich
- 1984: Request of data for the years 1981-1983 (1985) by WMO
- 1985: 3rd planning meeting of WCP-Water in Geneva
- 1987: The Fed. Institute of Hydrology (BfG) started to take over data sets; processing of the data for 1981-1983
- 1988: 4th planning meeting of WCP-Water in Paris
- 14 Nov. 1988: Official inauguration of the GRDC at the BfG**

14 Nov. 1988: Official inauguration of the GRDC at the BfG

- 1988: Workshop “Global Runoff Data Set and Grid Estimation” in Koblenz
- 1990: 5th planning meeting of WCP-Water in Laxenburg, Projects A.8 (Detecting global and regional runoff trends by monitoring discharges of selected rivers) and A.9 (Monitoring changes in the characteristics of extreme hydrological events) were established
- 1990: Request of data for years 1984-1988 by WMO
- 1992: Workshop “Global Runoff Data Centre” in Koblenz
- 1994: 6th planning meeting of WCP-Water in Wallingford
- 1994: 1st GRDC-Steering Committee
- 1995: 2nd GRDC-Steering Committee
- 1997: 7th planning meeting of WCP-Water in Koblenz
- 1997: 3rd GRDC-Steering Committee
- 1999: 4th GRDC-Steering Committee
- 2001: 5th GRDC-Steering Committee

Annex 8

**Summary of GRDC relevant CHy XI
results**

Eleventh Session of the WMO Commission for Hydrology

Abuja, 6-16 November 2000

Provisional list of results relevant to the work of GRDC

4	Decisions of Congress and Executive Council of relevance to HWRP
4.5	WMO Cg-XIII, 1999, kept in force GRDC Resolution 21 (Cg-XII, 1995).
11	Basic systems
11.8.2	GRDC was requested to consider setting up a global meta-database, starting with 200 discharge stations on major rivers flowing to the oceans. Set-up of an Internet-based metadata information system (physical and topographic features of basins, land use and hydrology.)
12	Applications of Hydrology
12.5.3-5	Progress was made with the proposal to establish the International Groundwater Resources Assessment Centre (IGRAC) in The Netherlands. After an IHP/UNESCO resolution in June 2000, CHy adopted Recommendation 1 (CHy-XI)
13	WHYCOS
13.12	WHYCOS projects must 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.
14.	Exchange of hydrological data and products
14.2.	In Res. 25 Cg-XIII requested the Executive Council to: ...invite the Commission for Hydrology to provide advice and assistance on technical aspects of the implementation of the practice on the international exchange of hydrological data and products; CHy AWG (P.Pilon and P. Mosley) prepared - Brochure on Resolution 25 (Cg-XIII) and - Technical note on the types of data that were exchanged
14.3	Implementation: first step: multilingual brochure on Res. 25 (Cg-XIII)
14.4	Implementation: second step: articles in scientific and technical journals
14.9	CHy noted the need to identify the source of all data. AWG should take all steps to ensure that CHy plays its full role in implementing Resolution 25 (Cg-XIII)

17	Future programme of work of the commission
17.4	Subject oriented working groups should define projects, one on metadata (in association with the GRDC)
17.5	AWG proposed a project Global Flood Forecasting System. Who sponsors?
17.6	At the last GRDC-SC meeting it was indicated that UNESCO would be prepared to support financially an initial meeting of experts for the development of an automated real-time stage-discharge system initiative.
18.	Technical cooperation, the Voluntary Cooperation Programme etc
18.1	Technical cooperation activities of WMO in the field of freshwater are focused in HYCOS-Projects
18.4	Hydrological data rescue project: 6 African countries: Chad, Gambia, Ghana, Kenya, Rwanda and Togo Russia seeks for similar projects assistance
18.5	Mexico and Tanzania received technical assistance from World Bank for Water Resources management projects.
19	Cooperation with water-related programmes of other organisations
19.1.2	WMO has published a paper edited by Igor Shiklomanov (Russia) on the assessment of water resources and water availability which served as one of the background papers for the UN-CSD report “Comprehensive assessment of the freshwater resources of the world”, published 1997.
19.1.3	Germany convenes an International Conference on Freshwater in Bonn from 3 to 7 December 2001
19.1.17-19	Information about the WMO and G3OS initiative to establish GTN-H was given. It was recommended to avoid duplication of efforts to not impose unnecessary burden on NHSs
21.	Nomination of experts and working group members: CHy-Advisory Working Group: Member responsible for international data exchange: J. Wellens-Mensah (Ghana) Working Group on Water Resources Expert on Data Management: M. Kaneki (Japan), Expert on Network Design: M. Morell (France), Expert on Rating Curves/Flow Derivation: N. Crookshank (Canada)

Annex 9

**Summary of vision statements of the 4th
GRDC Steering Committee**

Vision Statement agreed upon by the 4th SC 1999 (item 6.6)

The GRDC

- **Is recognised as the definitive archive of and distribution centre for high-quality discharge Data and related meta-Data;**
- **Receives a steady stream of Data;**
- **Produces and distributes value-added Data related products;**
- **Promotes and is actively involved in studies addressing regional and global issues.**

Strategic Development of GRDC (item 7)

GRDC should:

- close data gaps in data sparse regions (7.5)
- maintain and continuously update the database (7.6)
- identify topic-related „Targeted Networks“ like ARDB and “discharges to the oceans” (7.7)
- data collection according to needs of programmes such as GCOS, GTOS, GEMS/Water GIWA/GPA (7.8)
- liaise with regional HYCOS Centres (7.9)
- develop closer links with regional FRIEND groups (7.9)
- identify other regional or national bodies willing to co-operate with GRDC (7.9)
- develop close collaborations with major River Basins Authorities (RBAs), like Niger, Zambezi, Senegal, Mekong rivers (7.10)
- obtain institutionalised access to near real-time discharge Data from NHSs, Regional WHYCOS Data Centres and other sources (7.11)
- enhance the feed-back loop between GRDC and Data providers (7.12)
- clarify with CHy the role of GRDC with regard to the role of WMO World Data Centres. (7.13)

Implementation of the strategic outreach (item 8)

GRDC should:

- prepare an overview of GRDC's contribution to major global projects (8.2)
- jointly market GRDC and GEMS/Water programs vice-versa (8.3)
- pro-active participate in the formation of strategic alliances (i.e. WHYCOS, GEMS, GIWA, FRIEND, HELP, GTN-H) (8.4.)
- to acquire data in Africa, contact regional/subregional bodies dealing with Hydrology such as Agrhymet-OMVS-OMVG, SADC, National Hydrological Services and River Basin Authorities (8.5)
- foster product development, form partnerships to undertake projects (8.6)
- organise a „Products Workshop“ (8.7)
- collect meta-Data to put discharge Data into perspective (8.8) about land-use, abstraction/diversion/Water use, quality of Data, regulation/in-stream structures/diversions (8.9)
- expanded efforts to obtain additional information on „Large Dams and Reservoirs“ (8.10)
- define and implement a quality assurance program (8.13)
- organise an Expert Meeting on the “Automation of QA/QC Procedures for Real-time Estimation of Water Level and Discharge Data” under the joint auspices of the WMO and UNESCO (8.14)
- compile a searchable, comprehensive database of Data providers, users and collaborators (8.15)
- develop and prepare country reports serving as incentives to NHSs (8.16)
- update key reports with a monitoring character such as the GRDC-Report No. 10 “River discharge into the Oceans” (8.17)

Annex 10

**Revised GRDC Policy Guidelines for
Dissemination of Data and Costing of
Services**



Policy guidelines for the dissemination of data and costing of services

Preamble

The Global Runoff Data Centre (GRDC) operates under the auspices of the World Meteorological Organization (WMO), on the advice of its international Steering Committee and in co-operation with organizations such as UNESCO, UNEP, WHO and ICSU. These Guidelines regulate the acquisition and dissemination of hydrological data and the costing of services by the Global Runoff Data Centre under the Terms of Reference stipulated during the First Session of the Steering Committee of the GRDC and the commitments of WMO made at its Twelfth Congress in 1995.

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

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

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

1. Principles of data acquisition and access

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



2. Dissemination of GRDC-Data

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

2.2 Requests for data must reach the GRDC in written form: letter, facsimile, telex or email. A proforma is attached for use in this respect (Annex 1).

2.3 The data user agrees in writing that the data received are not transferred to third parties without the written consent of the GRDC. ~~GRDC data are released upon receipt of a signed User Declaration (Annex 2).~~ GRDC data are released upon identified access, e.g. a signed User Declaration (Annex 2)

2.4 GRDC data shall not be used for commercial purposes without the prior consent of Members and other providers of data to the GRDC. The GRDC will request such consent on behalf of a potential user.

2.5 The data user agrees that the GRDC may inform the Members and other data providers of data about the use to which their data have been put and will transfer the names and addresses of the data users to Members and other data providers concerned.

2.6 The GRDC makes available subsets of the GRDC database on request, as stated above. Requests for the entire database or substantial parts of it cannot be entertained **unless consent of the WMO secretariat has been obtained.**

3. Cost of services

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

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

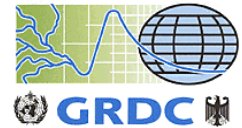
3.3 Standard GRDC services (Annex 3) are free for agencies and institutions which contribute data to the GRDC, as well as for the secretariats of international organizations which are the principal clients of the GRDC, such as WMO, UNESCO, UNEP and WHO.

3.4 For all other users, the cost for databank queries, diskettes, mail and all other overheads is based on the current price for services charged by the Federal Institute of Hydrology, Koblenz (Annex 4).

3.5 Under special arrangements, the cost for database queries may be waived for data users of developing countries.

4. Disclaimer

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



Annex 1

Format for Data Request from GRDC

Any request for data should provide the following information:

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



Annex 2

Declaration of the Data User

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

1. The GRDC data are not transferred either in part or total to third parties or to the general public (e.g. by electronic media), without the written consent of the GRDC.
2. The data will not be used for commercial purposes without the written consent of the GRDC. The GRDC itself will obtain clearance from the respective Members or other data providers prior to the release of data for commercial purposes.
3. The data set will be not accessible to unauthorised persons and, after completion of the specified studies, the data set will be kept separate from the general data processing facilities on diskette, tape or CD.
4. After completion of the studies and parts thereof, two copies of the results will be made available for the GRDC, as well as publications arising from the use of the data set or parts thereof.
5. In all publications, the source of the data will be fully cited as: "The Global Runoff Data Centre, D - 56002 Koblenz, Germany".
- 6.. The GRDC operates on a non-profit basis. In certain cases, however, the GRDC may charge the data user a nominal amount for data queries and handling or an amount which has been agreed upon between the requesting agency and the GRDC prior to data delivery. The undersigned confirms his/her capacity to pay bills presented by the GRDC for services.

7. Disclaimer

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

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

Place and date : _____

Signature : _____



Annex 3

Standard Services of GRDC

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

Production and dissemination of catalogues and yearly status reports

Database queries and response to data requests including advisory services with regard to the use of the database

Compilation of project/programme related sub-databases

Production of tables and graphs to illustrate and enhance the understanding of the content of the database

Production of reports in the GRDC – Report series for example on global/regional hydrological issues, in the interest of projects/programmes of, inter alia, WMO, UNEP and UNESCO

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

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



Annex 4

Cost of GRDC Services

1. Staff time is based on a per hour rate which in ~~June 1997 was set at DM 75,--~~ July 2002 was set at €40,--. This includes all overheads and mail services.
 2. To give an indication of the approximate costs of databank services, the following can serve as a guideline:
 - a) Simple queries, such as a search for all stations of three major rivers and the extraction of mean daily discharge data:
Estimated time for completion: 1.5 hours
Approximate cost (~~June 1997~~): ~~DM 112,50~~ (July 2002): 60,--
 - b) Complex queries, such as the selection of daily discharge time series of at least 20 years for 20 stations from three major rivers, with maximum overlap of time series:
Estimated time for completion: 5 hours
Approximate cost (~~June 1997~~): ~~DM 375,--~~ (July 2002): 200,--
 3. For complex tasks where data products (statistical evaluations, graphics, etc.) are also requested, a cost estimate is made and agreed upon in advance.
 4. Services for projects which require extensive work at the GRDC or the establishment of an own database are agreed upon in a Memorandum of Understanding (MoU) between the project partners. In these cases, the financial contribution for the services of the GRDC are prized and incorporated in the MoU.
 5. Payment for services is by bank transfer to the credit of the GRDC:
BUNDESKASSE KOBLENZ, LANDESZENTRALBANK KOBLENZ
BLZ: 570 000 00, ACCOUNT: 570 010 01, credit: 1203/11902 GRDC
- Cheques sent by registered mail and made payable to "GRDC" are also acceptable.

Annex 11

**GRDC collection criteria for discharge
data**

GRDC station selection criteria

Information note on GRDC station selection criteria, data format and data transfer

I. Which information the GRDC is interested in?

The GRDC aims to maintain an up-to-date collection of world-wide data on discharge that comprehensively represents the runoff situation at a global scale. However, given the many conceivable scientific questions and applications of such data, it is not easy to define unambiguous, crisp criteria for what should go into the database and what should stay outside. On the contrary, some criteria may even be contradictory which results from different potential uses. For illustration imagine e.g. the following three examples:

- * Trend analysis for climate change which relies on long-term records of preferably undisturbed catchments, which usually implies small catchments.
- * On the other hand, the estimation of the annual freshwater flux into the oceans in the first place requires information of the large streams.
- * Forecasting tasks require up-to-date, so-called Near-Real-Time (NRT) information.

In section III of this note we therefore list criteria, which should be regarded as guidelines rather than as strict rules. We consequently ask for the provision of data which meet a few of the criteria stated there, but not necessarily all, as such stations are hardly available.

II. Metadata

Apart from the actual data, in any case the GRDC appreciates to be provided with a complete METADATA list of ALL gauging stations in a country or region as to be able to oversee and analyse the situation itself. Furthermore, on request the GRDC could thus serve the data provider as a free-of-charge advertiser and directory for his data, e.g. by putting the metadata table on the GRDC-homepage and linking to the provider.

A metadata table features row-wise all interesting information about the stations, ideally providing information under the following column heads (of which the 5 most important ones are marked by **):

(1) Basic Station Information

- station no
- station name **
- river name **
- basin name
- country name
- latitude **
- longitude **
- altitude
- catchment size **
- daily data available from
- daily data available until

GRDC station selection criteria

- percentage of missing values (daily data)
- monthly data available from
- monthly data available until
- percentage of missing values (monthly data)
- mean annual streamflow

For those stations whose data series' are delivered to the GRDC we ask to be provided with a few further metadata entries:

- main stream or main basin name
- date when measurement started (YYYY-MM-DD)
- date when measurement stopped (YYYY-MM-DD)
- name or ID of succeeding station
- date of station reactivation (YYYY-MM-DD)
- information on method of measurement
- information on data quality check
- additional parameters measured?
 - + water level (y/n)
 - + water temperature (y/n)
 - + sediments (y/n)
 - + water quality parameters (y/n)

(2) Information about the Data Supplier: To establish a closer collaboration and to give feedback about the data use the GRDC needs to know your co-ordinates. (This information is only needed once per consignment!)

- The full postal address of the or-organisation handling and delivering the data **
- The name and email address of a focal point in your country **

III. Guiding criteria

The guiding criteria for the selection of a station for provision to the GRDC (only a few are sufficient to select a station) are:

- stations at rivers which reflect the hydrological regime of a region or part of a country best
- stations at rivers which are economically important in terms of population density and/or agro-based or industrial production
- last downstream stations at rivers which drain into the oceans or have an internal drainage
- stations with annual average discharge
 - greater than around 100 cbm/s
 - among the 10-50 highest in a region or country
- stations with basin sizes
 - greater than around 25.000 sqkm, if next station to the sea
 - greater than around 50.000 - 100.000 sqkm
 - among the 10-50 largest in a region or country
- stations at rivers where the basin population is greater than 1.000.000 inhabitants

GRDC station selection criteria

- stations of rivers in pristine basin (often very small ones)
- stations with long records, i.e. longer than 30-40 years, ideally covering the WMO periods 1931-60 and 1961-90.
- stations with up-to-date information (1990-now)
- stations which provide Near-Real-Time (NRT) access to current data, preferably via internet

IV. Method of data transfer

The favourable way of transferring data to the GRDC is email. Please note: When sending us the data by email there is a limitation of size (5 MB) for attachments in our institute. When the file size exceeds this limitation it will be possible to use FTP instead. Of course CDs, diskettes or even printed media send by postal mail are welcome, too.

V. GRDC's preferred data file format

Below we describe our preferred data and file format that will facilitate our data processing largely. However, if there are problems in generating this format, the GRDC accepts different formats, too. In this case, of course, we need a comprehensive file description.

Preferred File Format

- The file should be delivered in standard text (DOS ASCII) or MS-Excel format (*.xls).
- It is recommended to use spaces instead of tabs as column separator.
- Ideally there should be one file per station for either daily and for monthly data.
- The discharge values should be given in cbm/s.

Preferred Data Format

- Line 1: International river name in uppercase letters.
- Line 2: Station name in uppercase letters
- Line 3 to end: YYYY-MM-DD, Value (10 digits)
- Missing discharge values should be marked as -999.000.
- For monthly values please use 00 for DD.
- For daily data, please expand each month to 31 days using -10.000 or -999.000 as non-available value.

Example for a daily data file:

```

CONGO
BRAZZAVILLE
1978-01-01  1860.000
1978-01-02  1865.000
1978-01-03  -999.000
:
1978-02-30  -10.000
:

```


Annex 12

**Results of the brainstorming session under
agenda item 10.1 on meta-databases**

Results from the polling card survey on agenda item 10.1 (metadata)

The following is an almost literal summary of the polling cards filled by the participants of the GRDC Steering Committee which had been jointly grouped in categories during the meeting. While going through this material it has been rearranged moderately and enumerated for the purpose of easy reference. Only very obvious spelling errors have been corrected. The material is given here to demonstrate the variety of opinions and to also the weight given to some items. The quintessence is being summarised in the respective item of the main report.

GRDC should ...

... participate in working groups on metadata:

1. recommend to WMO, UNESCO and other international agencies to form a panel (WG) on “Hydrological meta-database of existing meta-databases.”
2. Liase with WWAP in development of an information system.
3. Contact UNESCO and WMO-Commission on Basic Systems to organise a workshop on needs for metadata, development of a concept for implementation.
4. to cooperate with WMO-WG to develop an international recommendation on the possible (feasible) structure of a metadata base.
5. GRDC to participate in task group (to be formed by WMO + UNESCO).
6. GRDC may participate in fora on metadata in order to learn how others are identifying their metadata.
7. participate in working groups on metadata systems - to get overview of emerging techniques.
8. close cooperation with other agencies in the development of an international meta-database on existing meta-database systems (global, regional, riverbasins, national, subnational).
9. Keep information related to metadata in view and take advantage of opportunities that may come up.

... produce link list to existing meta-databases:

10. At the higher level, GRDC should as much as possible try to identify existing meta-databases and how to point to or link to them
11. close cooperation with other agencies in the development of an international meta-database on existing meta-database systems (global, regional, riverbasins, national, subnational).

... produce link list to relevant internet sites at river basin level:

12. On river basin level, provide links to selected relevant sites → (collaborative effort)

13. GRDC to start to provide links to relevant Internet sites at basin level

... collect the following meta-database entries:

(1st priority)

14. define meta-database

- basic data (priority)
- additional station information
- basin information
- publication (year books, monograph)

15. core elements:

- GRDC station
- river name
- station name
- size drainage basin
- mean vol-Q

16. metadata to be expected for GRDC (essential)

- Name
- Ordinate
- Catchment area
- Name of River/River Basin
- (Height of zero point)
- if the data are obtained researcher/user may use data? (permission status)
- Data source (contributing agency correspondence)
- Data period

- mean Q
- is the Q influenced by anthropogenic measures Y/N?

(2nd priority)

- rating curve
- basin drains into which ocean?
- downstream node
- annual runoff coef. (→ needs basin → needs shifted coordinates)

17. The minimum requirement of metadata is the

- method of observation
- local geography
- water use in upstream

... consider general comments and recommendations related to the topic of metadata:

18. Metadata in GRDC must be minimum.

19. Metadata in data-provider may be big. Discharge data must be standardised

20. There are so many items relevant to data. For example Japan includes financial matters also to the database. Users will not have any interest in such items.

21. To develop the meta-database of GRDC in such a way, that its structure can be used by those countries who don't have meta-database at present.
22. GRDC should engage a consultant to work on the issue of metadata
23. An international general hydrological meta-database will need permanent supervision which is expected to be time-consuming. Else: users would be lost in a jungle of information.
24. GRDC should concentrate on collecting and archiving basic metadata elements on surface water provided by data suppliers. GRDC may also consult "INFOHYDRO" Manual/Report (WMO)
25. GRDC to provide documentation on its own present concept and state of development of its meta-database and time frame and station priorities
26. present GRDC station catalogue as template
27. Develop template/format based on experiences in GRDC and suggest its use by NHSs, which do not already have a well-developed meta-database. Such template/format could be adopted by existing and proposed HYCOS projects

... consider general comments and recommendations:

28. Keeping the accuracy of data is on the responsibility of the data provider.
29. On river basin level, provide basic visual information (i.e. maps), regime hydrographs etc.
→ collaborative effort

Annex 13

**Results of the brainstorming session under
agenda item 16 on future GRDC activities
and priorities**

Results from the polling card survey on agenda item 16 (future activities)

The following is an almost literal summary of the polling cards filled by the participants of the GRDC Steering Committee during the meeting. While going through this material it has been rearranged moderately and enumerated for the purpose of easy reference. Only very obvious spelling errors have been corrected. The material is given here to demonstrate the variety of opinions and to also the weight given to some items. The quintessence is being summarised in the respective item of the main report.

1. Papers (or at least charts showing main result) using GRDC data should be put on the GRDC homepage, or at least linked
2. Publication of (weekly, daily) State of the World Water Report (countries in the Blank Area will have difficulty to catch international attention. So, it may become a sort of incentive to contribute data)
3. Publication of (annual, monthly) State of the World Water Report
4. GRDC's involvement to the 3rd World Water Forum may be beneficial both for GRDC itself and global society. GRDC has the concrete, objective data on the state of world water.
5. Data Cross Check System between GRDC and GPCC is advisable.
6. Enhance cooperation GRDC-GPCC
 - joint river basin-related metadata
 - joint river basin precipitation and runoff products
7. Future GRDC activities: Priority list
 - 1st prior: data acquisition and archiving (data bank)
 - 2nd prior: archive security
 - 3rd prior: development of products

Annex 14

**Information on the HELP programme,
UNESCO**

Real people, real catchments, real answers

HELP – how does it work?

HELP is founded on a global network of catchments. National or local authorities can suggest catchments for inclusion. Catchments will need to fulfil the HELP criteria for baseline physical and socio-economic data exchange and provide adequate local capacity to further the programme. The benefits of inclusion are access to new data acquisition and analysis methods, sharing of expertise, access to data and findings from the other HELP catchments, and opportunities for funding and building capacity in water institutions.

Water managers and stakeholders

You can help to define the practical results that HELP is working towards. You are aware of the local problems and hence you have a vital role in formulating the agenda of HELP. Being at the interface between science, law and policy you can provide a vital link between science and society.



Policy makers

By appreciating the science better, you can help to provide scientists with questions relevant to legal and policy issues. Addressing the issues of legal entitlement, you can assist in ensuring peaceful, long-term, equitable access to adequate water for current and future users in a flexible, predictable and enforceable framework. You have a vital role in devising an effective legal and policy regime for equitable and sustainable use of water resources. This will identify the scope of the resource, alternative schemes for balancing every user's interests and ways of verifying compliance, so as to allocate the use of the resource fairly among all the stakeholders.

Water scientists

You need to communicate your research results to appropriate water resources managers. Your science should be delivered through innovative experimental field designs linking water-related physical and non-physical observations. Moreover, it should comprehensively address the effects of scale, recognizing that these may differ for the physical and non-physical issues. Your main role is to provide improved understanding of hydrological processes controlling both water quality and quantity, their relationship to ecology and how these affect or are affected by social, economic and legal structures.

Funding agencies

You can support HELP by recognising and endorsing its objectives and supporting research projects that are locally driven and address the specific needs of people in water-scarce areas of the world.

Register
your
interest

If you wish to register your interest in HELP or need further information about the background or future programme, visit the website <http://www.unesco/science/help> or contact Dr Mike Bonell, UNESCO, 7 place de Fontenay, 75352 Paris 07 SP, France telephone +33 1 45 68 10 00, fax +33 1 45 67 16 90, email m.bonell@unesco.org



HELP is a joint initiative of the
United Nations Educational Scientific and Cultural Organization (UNESCO)
and the World Meteorological Organization (WMO).



Hydrology for the **Environment**, **Life** and **Policy**

HELP is a new initiative to establish a global network of catchments to improve the links between hydrology and the needs of society.



The vital importance of water in sustaining human and environmental health has been widely recognised by numerous national and international fora. However, no



international hydrological programme has addressed key water resource management issues in the field and integrated them with policy and management needs.



HELP will change this by creating a new approach to integrated catchment management.



HELP is a problem-driven and demand-responsive initiative, which addresses five key issues:

■ Water and climate

■ Water and food

■ Water quality and human health

■ Water and the environment

■ Water and conflict



HELP's goal is to deliver social, economic and environmental benefits to stakeholders through sustainable and appropriate use of water, by deploying hydrological science in support of improved integrated catchment management.

Annex 15

Summary report on FRIEND provided by

Dr Gustard, CEH

**Global Runoff Data Centre (GRDC)
Koblenz, Germany**

Fifth Steering Committee Meeting, 25-28 June 2001

STATUS REPORT ON THE FRIEND PROJECT

1. Introduction

The FRIEND (Flow Regimes from International Experimental and Network Data) research programme is an international collaborative study in regional hydrology. It is a major contribution (Project 1.1) to the fifth International Hydrological Programme of UNESCO. Its primary aim is to develop, through a mutual exchange of data, knowledge and techniques, a better understanding of hydrological variability and similarity across time and space. This will advance knowledge of hydrological processes and flow regimes and improve practical design methods and techniques for analysing scenarios for environmental change. Capacity building, especially in developing countries, is an important part of the project.

FRIEND research is conducted at a regional level and is not confined by national boundaries. This has been achieved by developing international hydrological data bases of time series and spatial data and by establishing international project groups which exchange models and techniques and apply a common approach to the analysis of data over different hydrological regions.

Since its inception in Northern Europe in 1985 the project has grown considerably and now involves about 100 countries world-wide. To date, eight regional FRIEND groups (see Figure 1) have been established in Northern Europe, the Alpine and Mediterranean region (AMHY), Southern Africa, Nile Basin, West and Central Africa (AOC), the Hindu-Kush Himalayan region (HKH), Asian-Pacific region and the Mesoamerican and Caribbean region (AMIGO). Each is run independently with support provided by the FRIEND Intergroup Coordination Committee (FIGCC) which meets biannually. The next meeting will be in Maastricht, Netherlands in July 2001 in association with the 6th Scientific Assembly of IAHS.

2. Recent FRIEND activities worldwide

This last few years has been a period of consolidation for FRIEND, with real progress being made by many regional projects. During this time FRIEND has continued to play a key role within the fifth International Hydrological Programme (IHP-V). Its influence looks set to expand further in IHP –VI, from 2002 until 2007, with FRIEND being elevated to the status of a “cross- cutting” programme with linkages to many themes and focal areas. It is hoped that IHP-VI will see the continued expansion of FRIEND worldwide, and new projects in Central Asia, USA, South and Central America and the Persian Gulf and Caspian Sea areas are currently under consideration.

Recent developments of note include the success of relatively new FRIEND projects, such as Hindu-Kush Himalayan FRIEND, Asian Pacific and Mesoamerican and Caribbean FRIEND, in moving from the planning to implementation stage, with project groups being established and a busy schedule of collaborative meetings and training courses organised (see Table 2). Six project groups are now operational within HKH FRIEND including a snow and glacial hydrology group. HKH FRIEND has benefited enormously from close links with NE FRIEND, GRDC and the German IHP/OHP Committee, who have provided both funding and training opportunities. Likewise, Mesoamerican and Caribbean FRIEND/AMIGO and Asian Pacific FRIEND are now actively implementing their science plans with established and active project groups. Both are developing internet accessible databases. The benefits of collaboration are already evident in Asian Pacific FRIEND with the organisation of a number of workshops, attended by representatives from across this wide geographic region. These included a highly successful workshop on the Mekong River Basin held in Bangkok, Thailand in

January 2000, at which a range of modelling studies were presented and many problems related to the Mekong river raised and tackled. The third volume of the Catalogue of Rivers was published in 2000, which together with volumes 1 and 2, provides detailed hydrological information from 69 catchments in 13 countries.

Research within African FRIEND projects, namely Southern Africa, West and Central Africa and Nile FRIEND, has been boosted by the location of the fourth international FRIEND Conference in Cape Town, South Africa from 18-22 March, 2002. This has encouraged an unprecedented number of African hydrologists to submit extended abstracts to the conference. Other recent developments include the dissemination of a spatial data CD-ROM to all hydrological agencies in South Africa. This will be supported by future training courses on Geographical Information Systems. Progress within Nile FRIEND has in the past been hampered by problems over data sharing and a lack of funding. These have now largely been resolved, and major funding for the next three years, agreed by the Belgian Government of Flanders, should give new impetus to the project and enable progress to be made.

In Europe, there has been an expansion of AMHY FRIEND into the southern Mediterranean and North Africa, with the Lebanon and Tunisia joining FRIEND and contacts developed in the Palestine Territories and Morocco. CEH Wallingford has been successful in securing major funding for FRIEND from the UK Department for International Development (DFID), subject to the results of an external review of FRIEND. This review, which examined FRIEND activities worldwide in relation to the UK Government International Development Objectives, has just been completed. If successful, the funding will help support FRIEND activities in Southern Africa, Hindu-Kush Himalayan Region, increase involvement in FRIEND in eastern Europe and the Nile region as well as supporting UK FRIEND activities.

A more detailed review of developments within each regional project is outlined below and recent FRIEND meetings summarised in Table 1.

Northern European FRIEND (NE FRIEND), initiated in 1985, now includes participants from over 50 different organisations in 24 countries including Austria, Belarus, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Russia, Slovakia, Sweden, Switzerland, Ukraine, and the UK. The last Steering Committee meeting, in Stockholm, Sweden in September 2000, was attended by Dr T. Maurer from GRDC.

The extension of NE FRIEND into eastern Europe, facilitated by funding from INTAS, and the establishment of a regional datacentre in St Petersburg, Russia has led to much expansion in data held on the European Water Archive. The archive currently contains about 140,000 station years of gauged daily flow data distributed as follows:

Table 1 Summary of gauged daily flow data (GDF) on the FRIEND European Water Archive

Country	Total number of stations	GDF Stns	% GDF Stns	Earliest Record	Latest Record	Station years (GDF)	Average record length	Max record length
Austria	139	139	100	1922	1996	4520	33	75
Belarus	40	33	83	1919	1995	1383	42	77
Belgium	110	75	68	1929	1997	837	11	54
Bulgaria	3	3	100	1978	1986	27	9	9
Czech Republic	34	27	79	1887	1993	1468	54	104
Denmark	43	35	81	1917	1997	2115	60	81
Finland	71	68	96	1847	1997	3674	54	144
France	1476	1333	90	1863	1992	29734	22	128
Germany	790	698	88	1884	1998	26600	38	113

Greece	2	2	100	1978	1980	6	3	3
Hungary	26	25	96	1935	1996	825	33	62
Iceland	8	8	100	1932	1994	386	48	61
Ireland	130	77	59	1940	1997	1908	25	57
Italy	252	252	100	1925	1990	3969	16	66
Luxembourg	2	0	0					
Netherlands	37	32	86	1901	1994	694	22	93
Norway	214	205	96	1871	1999	7894	39	127
Poland	61	29	48	1955	1992	738	25	36
Portugal	73	73	100	1920	1994	1092	15	71
Romania	35	33	94	1838	1990	1155	35	153
Russia	217	199	92	1928	1995	8674	44	63
Slovakia	23	23	100	1930	1992	1441	63	63
Slovenia	12	12	100	1945	1990	300	25	45
Spain	45	45	100	1942	1995	1582	35	54
Sweden	71	66	93	1907	1992	2583	39	85
Switzerland	132	75	57	1904	1992	2775	37	82
Turkey	12	12	100	1958	1991	201	17	33
UK	1112	1015	91	1879	1999	30984	31	121
Ukraine	69	58	84	1960	1990	1798	31	31
Yugoslavia	5	5	100	1978	1990	63	13	13
Summary	5244	4657		1847	1999	139426	30	153

A wide range of spatial data is also held on a GIS ARC/INFO database. For further details and a meta-data catalogue please contact the Database Coordinator Mr Gwyn Rees at CEH, Wallingford (g.rees@ceh.ac.uk).

All project groups are actively engaged in research and all hold annual collaborative meetings. These have in the last year often been linked to conferences and seminars at which researchers can present their work to a wider audience. For instance, researchers working on large scale variations (Project 3) met in March 2001 at the European Geophysical Association Assembly, the Floods group met at a European conference on floods research in Potsdam, Germany in November 2000, while project group 5 (Catchment biogeochemical and hydrological processes) organised a joint conference with ERB (Euromediterranean Network of Experimental and Representative Basins) in Ghent, Belgium in September 2000. Members of the low flow group have been actively involved in the EU funded ARIDE project (Regional Assessment of Drought in Europe), and a sub group of East European low flow researchers has been formed. A textbook on Low Flows is currently under preparation by members of the Low Flows group.

Further information is available on <http://www.nerc-wallingford.ac.uk/ih/www/research/iresearch.html>

Alpine and Mediterranean FRIEND (AMHY) was established in 1991 to coordinate hydrological research in the Alpine and Mediterranean regions of southern Europe and North-west Africa. It now involves the active participation of 17 countries, including several in the south Mediterranean and North Africa. In 1999 coordination of the project passed from Dr Guy Oberlin at CEMAGREF to Dr Eric Servat, Director of IRD in Montpellier, France. The AMHY database is now maintained from this site. Research is organised into nine project groups including such topics exclusive to AMHY as integrated water resources management, very long times series and erosion and solid transport. The annual Steering Committee meeting was held in Montpellier, France in October 2000 in association with an international workshop on "Hydrology of the Mediterranean Regions".

Further information is available on <http://www.mpl.ird.fr/amhy/>

Asian-Pacific FRIEND was launched officially in 1997 and provides a framework for hydrological research over a wide geographic area of Southeast Asia and the Pacific. Collaborating countries include China, R. Korea, Japan, Philippines, Vietnam, Laos, Cambodia, Thailand, Malaysia, Indonesia, Papua New Guinea, Australia and New Zealand. A key factor in the evolution of the

project has been the publication of three volumes of the Catalogue of Rivers for Southeast Asia and the Pacific, presenting detailed information for 69 rivers from 13 countries. A science plan, published by UNESCO in 1999, brings together over 50 research proposals into five main research themes, with a current particular focus on the establishment of the Asian Pacific Water Archive and flood and low flow research. The archive is internet based with a central node at the Regional Humid Tropics Hydrology and Water Resources Centre in Kuala Lumpur, Malaysia with links to other centres in Japan and Australia. This archive presently includes available hydrometeorological and water resources information for Asian Pacific FRIEND and other IHP related activities in the region. A number of FRIEND workshops have been organised on such topics as floods and droughts in the 1990's and Mekong Basin Studies.

Further information is available on <http://titan2.cee.yamanashi.ac.jp/FRIEND/>

Mesoamerican and Caribbean FRIEND (AMIGO) the most recent FRIEND project, brings together 28 countries and administrative dependencies of the Mesoamerican and Caribbean regions. It provides a common theme to previously disparate research across this large number of small islands and Mesoamerican area. Since it was established in December 1999, the project has made good progress. The Steering Committee last met in December 1999 in Mexico and, since then, there have been inaugural meetings of the working groups on home page and database, eco-hydrology, maximum and minimum hydrological phenomena respectively.

Hindu-Kush Himalayan FRIEND, established in 1996, involves the active participation of eight countries including Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. The project has in recent years made real progress with the establishment of a regional hydrological data centre at ICIMOD, Kathmandu, creation of six working groups for research into floods, low flows, rainfall runoff, water quality, snow and glaciers and database, organisation of training courses and exchange visits by scientists. A workshop on surface/river water quality will be held in Islamabad in May 2001 and a joint FRIEND/ICSI (International Commission for Snow and Ice) workshop on glacier mass balance measurement techniques was held in March 2001 in Pokhara, Nepal. The Second HKH FRIEND Steering Committee meeting took place in Kathmandu, Nepal in April 2000, and inaugural meetings of five project groups were held during 1999 and 2000.

Nile FRIEND

This project, launched in 1996, is important for encouraging communication, cooperation and data exchange between the nine countries of the Nile Basin namely Burundi, Egypt, Tanzania, Ethiopia, Uganda, Kenya, Rwanda, Sudan, Zaire. It is hoped that cooperation agreements, developed as a result of FRIEND, will lead to long term improvements in the management of this major river basin. The Steering Committee last met in Cairo in August 2000. New funding of \$900,00 from the Belgian Government of Flanders should enable real progress to be made towards the key priorities of creating a regional database and developing training and capacity building in the region.

Southern Africa FRIEND

This project, initiated in 1991 involves the active participation of twelve countries in the Southern African Development Community (SADC), including Tanzania, Malawi, Zambia, Zimbabwe, Mozambique, Botswana, Lesotho, Swaziland, Namibia, South Africa, Angola and Mauritius. Now in its second phase, the project is focussing on water resource issues such as drought assessment and climate variability, regional water resources and river flow modelling and lake water-balance studies. Recent activities include the dissemination of a spatial data CD-ROM to all hydrological agencies, a low flow training course organised by CEH Wallingford in Malawi, and organisation of the FRIEND conference in Cape Town. The sixth Steering Committee meeting was held in Blantyre, Malawi in November 2000.

West and Central African FRIEND (AOC)

This project launched in Abidjan, Côte d'Ivoire in 1994 involves fifteen countries in West and Central Africa, including Benin, Burkina-Faso, Cameroon, Central Africa, Chad, Ghana, Guinea, Côte-d'Ivoire, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Now in its second phase, research is now focussing on the variability of water resources, modelling of hydrological processes,

low flows and sediment transport. A key achievement has been the establishment of the regional database (BADOIE), currently located at the regional coordination centre at AGRHYMET in Niamey, Niger. There are plans to make it available on the internet by the end of 2001. The Steering Committee last met in Niamey, Niger in June 2000.

Further information is available on <http://www.cig.ensmp.fr/~hhgg/aoc/friendaoc.htm>

Contact details of international FRIEND coordinators are included as Annex 1.

FRIEND 2002 Conference

Preparations are well advanced for the fourth international FRIEND Conference (convened jointly by UNESCO/ National Committee of South Africa, Southern Africa FRIEND, IAHS and WMO) to be held in Cape Town, South Africa from 18-22 March 2002. The Conference will focus on bridging the gap between knowledge, research and practical applications, with paper and poster presentations on the following themes: hydrological data; managing hydrological risk; water scarcity, over-exploitation and poverty reduction; sustaining water related ecosystems and continental hydrology. Extended abstracts have been submitted, and accepted abstracts selected. A second circular will be distributed in July. Further information is available at <http://www.ru.ac.za/institutes/iwr> or from the Conference Secretariat (Juanita@iwr.ru.ac.za)

In addition to conference proceedings published in the IAHS Red Book series, a FRIEND Report presenting a synthesis of FRIEND activities from 1998-2002 will be available. All regional FRIEND projects will contribute to the report.

Links with other international programmes

FRIEND continues to maintain links with several global scale initiatives such as GEWEX (Global Energy and Water Cycle Experiment), WHYCOS (World Hydrological Cycle Observing System) and GEMS/Water (Global Environment Monitoring System). Three on-going WHYCOS projects (MED-HYCOS, SADC-HYCOS, and AOC-HYCOS) coincide geographically with regional FRIEND projects and involve organisations which are also active in FRIEND. Within IHP-VI possibilities for collaborative research between these projects and the data centres they use, for example, the GRDC (Global Runoff Data Centre) and the GPCC (Global Precipitation Climatology Centre), and FRIEND will be sought.

There is also the potential for FRIEND to develop close links with a new global initiative launched in November 1999, entitled Hydrology for Environment, Life and Policy (HELP), which aims to provide the scientific basis for improved land and water management through a global network of experimental basins. Scope also exists for closer links between FRIEND and the Global Water Partnership, which FRIEND formally joined in October 2000.

FRIEND related research

A number of externally funded research projects have arisen directly from FRIEND. In the HKH region, the recently completed three year REFRESHA project, funded by DFID in the UK, has led to the development of low flow estimation methods for ungauged catchments in the Himachel Pradesh region of India and Nepal. These can be applied both for assessing the potential for small scale hydropower development and water resource assessment. CEH Wallingford have also been successful in securing DFID funding for a new three year study on snow and glacier aspects of water resource management in the Himalayas (SAGARMATHA) which began in May 2001. In Europe, a three year study assessing the regional impact of drought in Europe has just been completed and a final report published. This project, initiated by members of the NE FRIEND low flow group, included a pilot study on real time monitoring of drought incorporating new drought visualisation techniques.

Figure 1 Location of FRIEND projects worldwide

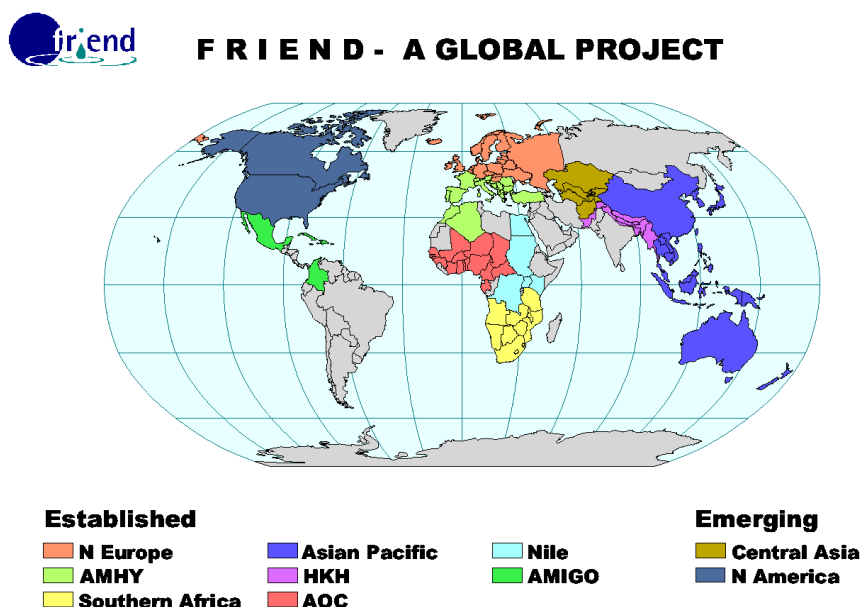


Table 2 Recent (2000-2001) and forthcoming FRIEND meetings

Region	Event	Venue	Date
All	Fourth International FRIEND Conference	Cape Town, South Africa	18-22 March 2002
All	FRIEND Intergroup Coordinating Committee (FIGCC)	Maastricht, Netherlands	24 July 2001
NE FRIEND	Steering Committee Meeting No 7	Stockholm, Sweden	14-15 Sept.2001
	Project 2: Low Flows Group	Warsaw, Poland	22-28 May 2000
		Freiburg, Germany	20-23 June 2001
	Project 3 : Large Scale Variations in Hydrologic Characteristics	Nice, France	26-30 March 2001
	Project 4: Floods	Potsdam, Germany	3 November 2000
	Project 5: Catchment Hydrological and Biogeochemical Processes in Changing Environment	Ghent, Belgium	26 September 2000
		Cracow, Poland	September 2001
AMHY	Steering Committee meeting and international conference	Montpellier, France	10 October 2000
HKH FRIEND	2 nd Steering Committee meeting	Kathmandu, Nepal	11-13 April 2000
	Inception meeting of rainfall-runoff modelling group	Kathmandu, Nepal	10 April 2000
	Inception meeting and workshop of floods group	Kathmandu, Nepal	14 April 2000
	Inception meeting of river water quality group	Kathmandu, Nepal	14 April 2000
	River water quality group training workshop	Islamabad, Pakistan	21-27 May 2001
	Snow and glacier group/ICSI workshop	Kathmandu, Nepal	20-24 March 2001

Region	Event	Venue	Date
	on glacial mass balance		
Southern Africa	6 th Steering Committee meeting Low flows training course	Blantyre, Malawi Lilongwe, Malawi	13-14 November 2001 29 Jan – 2 Feb 2001
Nile	Coordinators meeting 4 th Steering Committee meeting	Cairo, Egypt Cairo, Egypt	April 2000 August 2000
AOC	Steering Committee meeting	Niamey, Niger	June 2000
Asian Pacific	Workshop on Mekong Basin Studies	Bangkok, Thailand	24-26 January 2000
Mesoamerican and Caribbean	Meeting of working group on minimum hydrological phenomena Meeting of working group on homepage and database	Costa Rica	Nov 31- 3 Dec 2000 6-9 December 2000

Relevant international meetings

Event	Venue	Date
Sixth IAHS General Assembly: A New Hydrology for a Thirsty Planet	Maastricht, Netherlands	18-27 July 2001
International conference: Hydrological Challenges in Transboundary Water Resources	Koblenz, Germany	25-27 September 2001
ERB 2002 Conference: Interdisciplinary Approaches in Experimental Catchment Hydrology Monitoring and Research	Low Tatra Mts, Slovakia	September 2002
International conference: Hydrology in the Mediterranean and Semi-arid lands	Montpellier, France	April 2003

Annex 1 Contact details for international FRIEND coordinators

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Hindu Kush-Himalayan FRIEND

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Annex 16

**Summary report on GTN-H
implementation meeting**

GTN–H Meeting

21-22 June 2001, Koblenz , Germany

ACTIONS AND RECOMMENDATIONS

- Establish a web-page
 - Partners comments in the context 15.09.
 - MSC host the server 15.10.
 - Initial page for partner revisions 15.12.

- For each product (initial 5) short write-up 15.09.
 - Gridded discharge / runoff fields (**GRDC**, UNH)
 - Map product on data availability (GPCC)
 - Map product on state of the system (**GRDC**)
 - BGC-Fluxes into the Oceans (**GRDC**, GWCC)
 - Snow (NSIDC)

- Complete a mission/vision statement, ToR, framework for implementation by Coord.-Group
 - Short summary of the meeting 15.07.
 - Complete the draft mission statement 15.08.
 - ToR 15.11.
 - Develop an initial strategy 12.12.

SETUP OF THE INITIAL COORDINATION GROUP

GRDC
GPCC
GWCC
UNH
USGS
MSC

COORDINATOR (FOR THE 1ST YEAR)

David Harvey, MSC
Hydrometeorologist and Network Strategies
Atmospheric Monitoring and Water Survey Directorate
Meteorological Service of Canada

Annex 17

**Email correspondence on data quality
assessment and control with Dr Pilon,
MSC**

Discussion on GRDC QA/QC meeting

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From: Maurer, Thomas, M2/GRDC, MT [mailto:Thomas.Maurer@bafg.de]
Sent: March 6, 2001 10:44 AM
To: 'Paul Pilon (E-Mail)'
Subject: 2nd posting: GRDC QA/QC meeting just before the GRDC SC-meeting
=====

Dear Paul,

As you have been out of office for some time I assume that you are probably even more busy than usual... However, if for some reason you happened to lose my mail dated from 19 February 2001, I am sending it again below. If your schedule allows for it I would very much appreciate a brief statement regarding my suggestions.

----original text follows-----

Dear Paul,

It is already some time ago, when we meet in Abuja, where you gave me a very interesting instant 1 or 1 1/2 hours talk on time series and trend analysis, pointing out some pitfalls associated with this topic. By the way, is it possible to obtain a copy of your research paper on this topic?

Today I am writing because I would like to suggest to organise a meeting on the "Automation of QA/QC Procedures for Real-time Estimation of Water Level and Discharge Data" as it has been recommended at the 1999 GRDC SC-meeting (see point 8.14 of the SC meeting's report). From discussions with Wolfgang Grabs I understood that you were one of the major advocators for this meeting, that is why I contact you.

We were reasoning about to have this meeting just before our GRDC-SC-meeting this year, which is scheduled from 25 - 28 June. You have been the representative of the CHy to the meeting and though I have addressed the invitation formally to the president of CHy (D. Rutashobya) I assume that you will be the one to attend (right?). (First announcement follows this week.) How does it fit into your plans to have this QA/QC-meeting on 21 + 22 June 2001?

We thought of a small framework, i.e. approximately 5 participants should attend, parallel to another session at the same time on the implementation of the Global Terrestrial Network for Hydrology (collection of 10 near real time hydrological variables, organised by WMO). Who could be the participants? I have collected so far the following names which came to my mind in a brainstorming session:

- * Pilon, Paul, Environment Canada
- * Gustard, Alan, CEH
- * Kundzewicz, Zbigniew, Polish Academy of Science
- * Hubert, Pierre, Ecole des Mines de Paris
- * representative of Company Ott, Germany, hydrometric measurement equipment
- * Adler, Matthias, BfG
- * Engel, Heinz, BfG

Please let me know, what you do think about this proposal and about the people who should attend!

Though I think QA/QC is an very important topic, in my view the even more important topic is to first of all collect data. Here GRDC still has deficits. I think we have to improve services for the PROVIDERS, as to motivate them to do something for us. I am thinking of some kind of software tool, available free of charge from our web side, acting as an incentive. How could this combined with QA/QC workshop goals?

Looking forward to hearing from you.

With best personal regards,

Thomas

Discussion on GRDC QA/QC meeting

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

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From: Pilon,Paul [Burlington]
Sent: March 13, 2001 5:40 PM
To: 'Maurer, Thomas, M2/GRDC, MT'
Subject: RE: 2nd posting: GRDC QA/QC meeting just before the GRDC SC-meeting
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Thank you for having sent me your note for a second time. I have still not gotten through the pile of mail to the first letter you had written. Unforgivable of me, but the e-mail deluge is simply incredible.

Regarding your first point on obtaining a copy of our paper. We have sent a manuscript on the matter for publication and it currently is undergoing a peer review process. We are also in the process of preparing two additional manuscripts for publication. The first applies three approaches for the detection of trend within Canadian streamflow data. The results at times can be substantively different amongst these procedures. A comparison of our findings will also be made with respect to other Canadian studies and with some American studies, the latter for spatial continuity of results. I would be most pleased to send you a copy once the manuscript(s) has(ve) passed the peer review process. It has been submitted some time now without having heard the view of fellow scientists.

Regarding your second point in that I was an advocate of automation of procedures. Yes indeed I believe I was. But I would like to give some additional background to the concept I was advocating and link this with your last paragraph on what could be provided to users. The intent would be to develop an advanced software system that would allow the user to convert acquired water level data and convert them to discharge within a real-time system. The system would also be able to provide real-time displays on the diagnosis of potential collection equipment problems, and could at the same time provide advice to the local technologist/operator as to what corrective measures might be taken.

The intent of the system is to allow the world to see real-time estimated discharge data. These data would be derived at a reasonably high standard using the best possible methods and practices. Various QA procedures would be applied to water level and other data as they are fed into the system. As new data are provided, historical corrections can immediately be performed to provide the most recent best estimate of discharges (e.g., a rating has just been redefined due to a high water measurement making previous discharge estimates quite inaccurate).

Such a system would be of tremendous benefit to organizations involved in data collection due to the potential efficiency due to automation. Effectiveness also increases as high quality discharge data would be available almost in real-time, rather than several months after the fact.

Discussion on GRDC QA/QC meeting

Can you imagine this being used by the countries contributing data to your Centre. You would have data worked-up in a common manner, with advice and guidance being provided to the operators as to any potential problems that are being spotted. If they follow the guidance this should increase the quality and accuracy of the data collected.

This is the general pattern of thought I was attempting to portray in Koblenz at the last meeting of the Steering Committee. Quite possibly it does not mesh 100% with the very short title, due to limited space for explanations.

One very important aspect to this process is in establishing if it is indeed possible to automate the process of converting level to discharge. The second aspect is whether there may be an alternative approach to the conventional practice that would prove more reliable and accurate than the historically accepted model. We in Canada have discussed this, and I would suggest that this is an area of importance for international discussion. We continue to discuss this, and there may also be a possibility of us moving forward on this as well, depending on a number of things. In actuality, we are advancing, piece by piece, but there remain some critical steps not yet fully sketched.

I have been in correspondence with Mr. Darius Rutashobya, President of CHy, regarding CHy representation at the upcoming meeting. I had recommended to him, and it was felt that another member of the CHy Advisory Working Group would be able to represent most adequately our views.

Moving to your list of participants, I would like to mention that the invitees should reflect what you are hoping to achieve at the meeting, which I know is a rather shallow and obvious statement. The reason I mention this is that the meeting could be geared to seeing if the major players in data acquisition are interested in pursuing a "group" effort for development, or it could be geared to establishing if the idea is "technically and scientifically" feasible, followed by the development of a brief work plan (sketch out the problem and some potential solutions). In order to tackle this problem, as I see it, we first have to agree on a path forward, if indeed it exists (and I suspect it does). To put it one way, we either develop an artificial intelligence, expert system, to mimic the thought process and actions of the very best trained technologists in estimation of discharge from water level data. An alternative is to turn to modelling (e.g., hydraulic) and other parameters to estimate what may be occurring in the stream under varying conditions. (Some could argue that a mix of the two may be better.)

In order to assess the feasibility requires expertise from a number of areas to first understand the problem and then to grapple with the possibility of a system to replicate the human thought process, as a lot of interpretation enters into the equation, depending on conditions. In other words, the experts at the meeting can be organizationally high placed and have the authority to base decisions on moving forward, or they could be experts from different disciplines to discuss the pitfalls and abilities of their areas to deal with this problem. I suspect we want the latter, or is it a mix? Regardless, the experts need to know clearly what the steps are to estimating discharge so they can contribute to solving the problem.

When I had thought about a multi-disciplinary group, I felt one would want at least two extremely top hydrometric technologist/engineers who are very familiar with the day to day grind of working up data and the conditions they face and the approaches they use in doing so. I would also include really top people on hydraulic modeling, expert systems (AI), fuzzy logic, and hydrology, not to mention computer science. To get all of this in five people is the impossible, which is why I had thought more on the lines of the WMO/UNESCO/IH Expert Meeting held in December 1998 at Wallingford on detecting

changes in hydrological data. I believe we were probably closer to a dozen in number, with a relatively easier task at hand!

One additional dilemma is that the working up of data may not be the same in

Discussion on GRDC QA/QC meeting
all countries, and additional efforts might possibly be required just to reach consensus on approaches, if indeed that is possible.

In summary, I support your efforts to hold a meeting on the subject. We in Canada are very interested in this activity. Special care must be given to having not too many present at the meeting, yet sticking a balance of having the right mix of expertise. I am also inclined to want to suggest an invitation to the United States Geological Survey, given their expertise in this and related areas.

I look forward to your further views on these matters.

Regards,

Paul

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L7R 4A6
Canada

E-mail: paul.pilon@ec.gc.ca
Tel: (905) 336-6007
Fax: (905) 336-4989

=====
From: Pilon,Paul [Burlington] [mailto:P.Pilon@ec.gc.ca]
Sent: Wednesday, March 14, 2001 10:07 PM
To: 'Maurer, Thomas, M2/GRDC, MT'
Cc: Hale,Robert [CIS-WSB]
Subject: RE: 2nd posting: GRDC QA/QC meeting just before the GRDC SC-meeting
=====

Since sending my initial reply to you yesterday, I have been able to speak with Mr. Bob Hale, who is the Director of our Water Survey. We had discussed the importance of this meeting, and we would like to suggest that this meeting be held in Canada at our facilities in Ontario, possibly the Canada Centre for Inland Waters in Burlington.

At the last meeting of the GRDC Steering Committee, the representative from UNESCO indicated that he would be willing to financially support this meeting. The representative from WMO had also indicated, but with reservations regarding budgetary pressures, a willingness to support the meeting. Is it possible that we could bill this as a UNESCO/WMO/GRDC/Germany and Canadian meeting?

Holding the meeting in Canada could have some important advantages, as we have been working on parts of this problem for some time, and it would allow a more complete representation of various expertises, with possibly lower travelling and accommodation costs for many participants. In particular, we have Mr. Pat McCurry who has been leading the national modernization of hydrometric operations. An important element thereof is the automation of computations of discharge. Mr. McCurry is one of our foremost experts on hydrometric operations. As well, the WMO CHy Working Group on Water Resources Expert Norm Crookshank, whose CHy work program is closely aligned with this meeting topic and who also is a hydraulic modelling expert, is from Ottawa, Canada. We have also have Dr David Lam of our National Water Research Institute working with us on the expert systems aspects and who may be able to represent this niche at the meeting. As well there are some other experts who could help represent hydrometric and hydraulic problems typical of working water level data to discharge.

Discussion on GRDC QA/QC meeting

I had also suggested to you that there be the inclusion of expertise from the USA. I would also like to suggest that we may wish to obtain some expertise representation from a few other areas of the globe, namely New Zealand or Australia and possibly China or Africa. If you wish, we could make some inquiries as to who may be best and the areas they may represent. I still maintain a reservation about making the attendee list too large, as size may negatively impact on the effectiveness of the meeting. We must also be cognizant of having the meeting within a certain allowable budget, which is yet to be established.

I look forward to hearing from you further on these matters,

Regards,

Paul

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=====
From: Maurer, Thomas, M2/GRDC, MT
Sent: Monday, March 19, 2001 5:17 PM
To: 'Pilon,Paul [Burlington]'
Subject: RE: GRDC QA/QC meeting
=====

Dear Paul

Thank you very much for your in-depth replies to my inquiry concerning the QA/QC meeting as proposed in the 4th GRDC-Steering Committee Meeting, June 1999.

We have been discussing about the subject before and after receiving your replies and that's in summary what are our thoughts and comments:

A project plan heading for the improvement of the availability and quality of GLOBAL discharge data should answer the following questions:

- 1) Where do we stand right now?
- 2) Where do we need to go?
- 3) Which steps are necessary to take?
- 4) How to realise these steps in detail?

However, especially on an INTERNATIONAL SCALE we will quickly find that all these questions have to be elaborated under a variety of strongly interfering aspects as e.g. politics, international relations, standardisation, organisation, science, technology, infrastructure, capacity building, finances, time frames, spatial coverage to name the few most obvious.

The complexity of that task exponentially will grow with the gap we intend to bridge between 1) and 2) as it rapidly will become difficult to agree on a least common denominator.

The challenge for a workshop would be to first mark out the scope of our plan under consideration of all these aspects, i.e. to develop a clear idea of which circumstances we regard as given constraints or boundary conditions, and then to determine a priority list of FEASIBLE actions within the

established limits.

In our view, in your emails you have spoken preliminary of point 2) "Where do we need to go?" to which we all here agree IN PRINCIPLE. However, from my assessment of the status quo I feel the afore mentioned gap to be bridged as being to wide as to close it by an effort ON GRDC SCALE. In fact, WMO and other international organisations have a variety of ongoing activities to address the mentioned problems by pressing ahead some of the necessary steps, e.g. WHYCOS, GTN-H, GTOS, FRIEND, ISCSCP-II, Resolution 25 (CG-XIII) to name a few.

One may speculate about whether these efforts are coordinated enough and overseen by an appropriate structure and whether men in general are able to oversee a complex problem like ours without iteration. Thus, to achieve the goals you have in mind we better try to somehow link in with these already existing activities and try to exert influence there and maybe eventually slightly redirect these activities. But this is a long-term commitment and cannot be solved by one or some workshops without having a MANDATE from and an established contact to the mentioned activities already underway.

I do not see GRDC in a central position to become active here, though of course the GRDC should join these process as one among others. In this sense I would be glad to participate in any new activity that would be established on a suitable level, with a sufficient time horizon and financial resources. In fact I already see the GRDC as an integral part within such kind of a process, but as on the international level most has to be achieved in a CONSENSUS mode between countries and UN-organisations it remains difficult to strictly plan ahead step 3) as mentioned above.

But, within the existing structure, what can be realistically be achieved by the GRDC being dependent of (too often reluctant) data providers? We think we should request them to send us besides runoff data THEIR assessment of the quality of their data. This way we maybe able to eventually gather a mosaic (world map) of which THEY think are the influences on their data and shortcomings in their equipment (this might vary a lot in different climates and societies). From this type of insight we might be able to develop plans how to overcome the problems associated with data collection.

I would try to collect this kind of information in a first step where it should be comparatively easy feasible for us, i.e. in Germany. By the time we could develop a kind of catalogue of possible error sources and estimated magnitudes which could assist others in estimating their errorbars.

Concerning the real time component of our discussion, I already mentioned the GTN-H initiative. In communication with Wolfgang Grabs from WMO we decided to have an implementation meeting in Koblenz, again just before the GRDC-SC meeting. WMO will organise the scientific part of that meeting.

Having in mind my elaboration on maybe to complex tasks to solve them in a single step in a heterogeneous world, my proposal in this regard was as follows:

The GRDC is currently compiling an overview of available online discharge and water level data in the internet, which turns out to be harder as anticipated due to heterogeneity. On base of this I propose to produce a small GRDC-report which can serve as basis for further discussions. The following paragraph sketches a draft of its possible structure:

Draft title: Online river discharge and water level resources and future perspectives to integrate them.

1. Introduction (GTN-H, WHYCOS, GRDC etc.)
 - this is a report which has to be iterated,
 - i.e. please feel free to help in improving the collection and proposals
2. Summary of available online data sources
 - table "Summary"
 - map with stations
3. Heterogeneity of available online data sources
 - 3.1 Different types of data
 - 3.1.1 h/Q

Discussion on GRDC QA/QC meeting

- 3.1.2 temporal resolution
- 3.1.3 historic/near real time/real time
- 3.2 Different types of access
 - 3.2.1 graph/textbitmap/html/ascii
 - 3.2.2 type of bundling (single/basin/country/region)
- 3.3 Available metadata
 - table "available metadata"
- 4. Proposal for an unifying interface
 - 4.1 Necessary and desirable metadata
 - including discharge curves!!
 - 4.2 Data transmission and focusing scheme
 - simple but robust: central FTP-site
 - sophisticated but costly: internet metadata browser for heterogeneous distributed databases
- 5. Outlook

That report then should be distributed to those already providing data by the internet (15-20 countries). Then a meeting should be arranged to bring them together and somehow compromise on a common denominator in order to then step by step establish a concrete plan how to develop a prototype of integrated information system.

This seems to me to be a medium sized and thus feasible project heading for an intermediate goal. Still the difficulty remains to find sponsoring for it (e.g., the WMO budget seems to be already fixed until 2003?!!). One important oblique benefit of that kind of project would be to have something to show to both providers and users and thus to trigger the support to develop it further.

In summary:

- * GRDC is willing to participate in a discussion process as outlined in your emails.
- * GRDC will not take the lead in this, as it is beyond its mandate and capacities. We think such plans should be placed on a top-level programme and need long term commitment of many participants.
- * GRDC suggests the collection of the provider's assessment of their data quality. GRDC then could collect this information and make them available, e.g. as report.
- * GRDC suggests the implementation of the probably feasible task of unifying the already available online data. This nevertheless needs sponsoring, e.g. workshop costs.

I am looking forward to hearing your comments on this views and once again thank for your time you invest in this matters.

Best regards,

Thomas

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

Discussion on GRDC QA/QC meeting

=====
From: Pilon,Paul [Burlington] [P.Pilon@ec.gc.ca]
Sent: May 1, 2001 4:18 PM
To: 'Maurer, Thomas, M2/GRDC, MT'
Subject: RE: hotel reservations GRDC SC-meeting
=====

...

Regarding your second last e-mail, I was planning on formulating a response, and I had your note on my desk. I agree with you in that I do not see the GRDC as the global lead for the development of such a system. GRDC, as would the world, would benefit immensely from the creation AND adoption of such a system. I do believe that this role falls within the mandate of the WMO, which is considered to be the lead UN agency in matters pertaining to basic hydrometric data collection.

This topic should also link very closely with the WHYCOS/HYCOS initiatives, and such mechanisms should be used to advance the cause of data processing (quality control of data, conversion of levels to flows, standard procedures, etc)and data dissemination. Such topics were discussed to a limited extent in our last session of CHy, and some activities are proposed within one of the CHy technical working groups in these areas. Currently, I do not sense that the overall project yet is in a form to garner much favour in international circles, although at the last meeting of the steering committee, the representatives of UNESCO and FRIEND spoke in favour of it with UNESCO indicating a willingness to contribute financially to kick off the process through sponsoring an expert meeting. However, we do all realize that this is a very large task and one that is quite a challenge given the current issues facing National Hydrological Services and WMO. However, given the potential benefits of "modern solutions to old problems", it is important for us to persevere.

Regards,

Paul

Annex 18

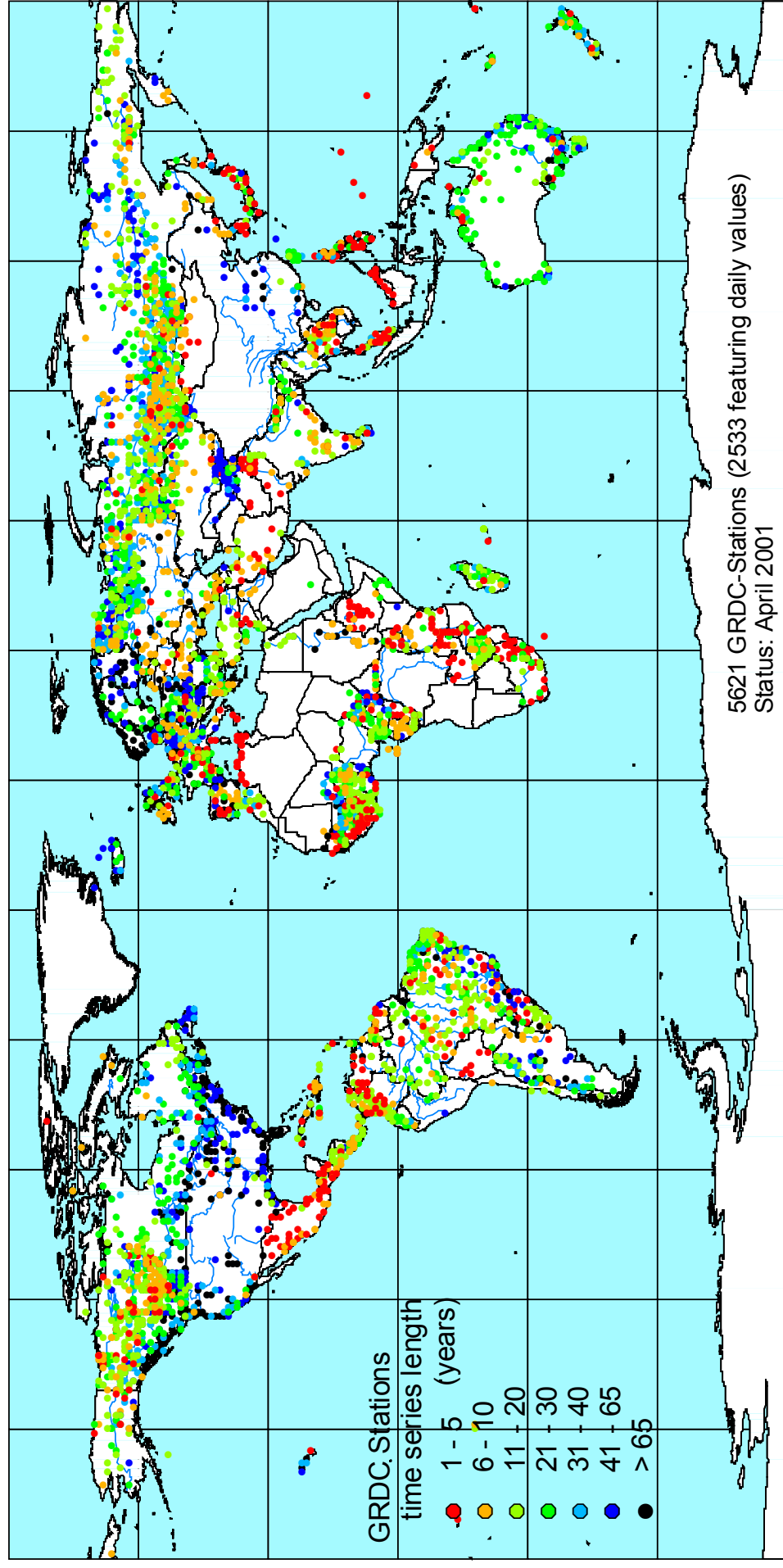
Status GRDC database and data imports

7/1999-6/2001

Standard services of the GRDC...



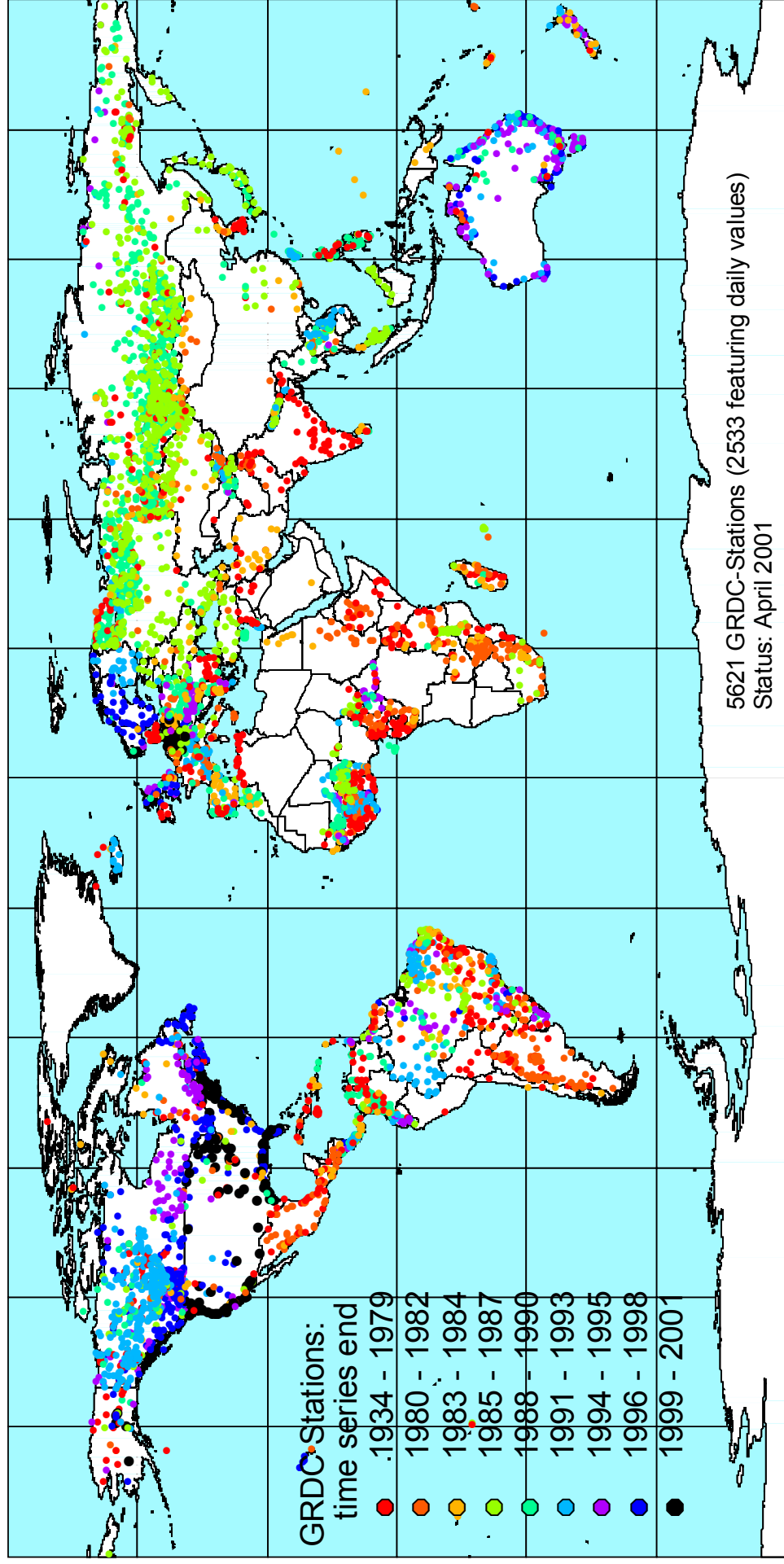
- Acquisition and processing of discharge data



Standard services of the GRDC...



- Acquisition and processing of discharge data

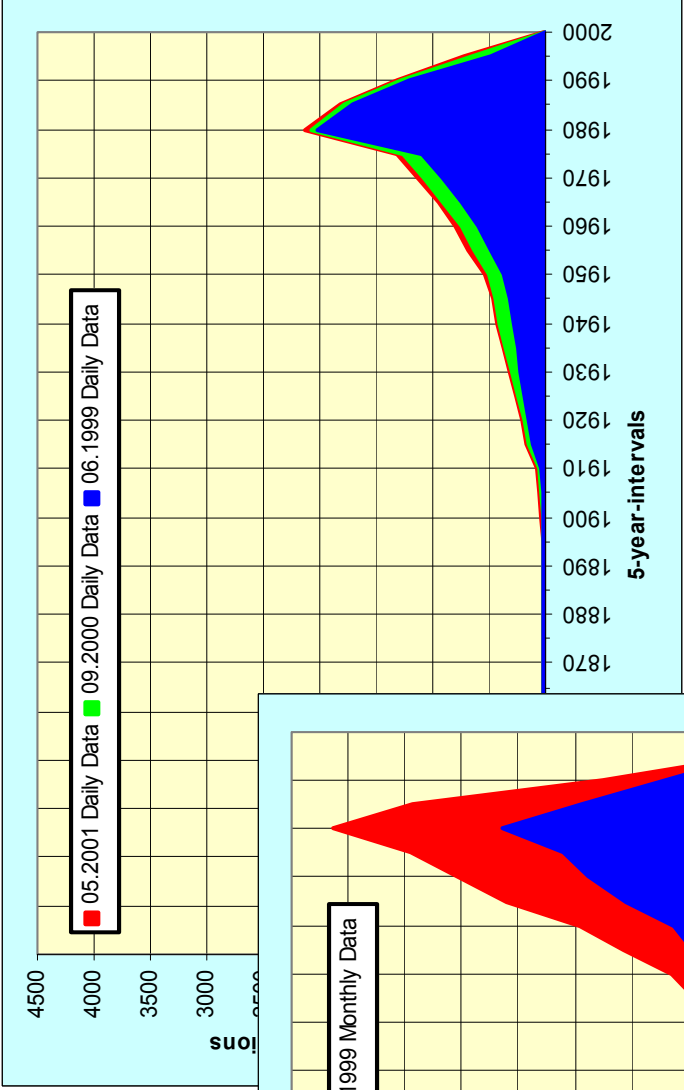
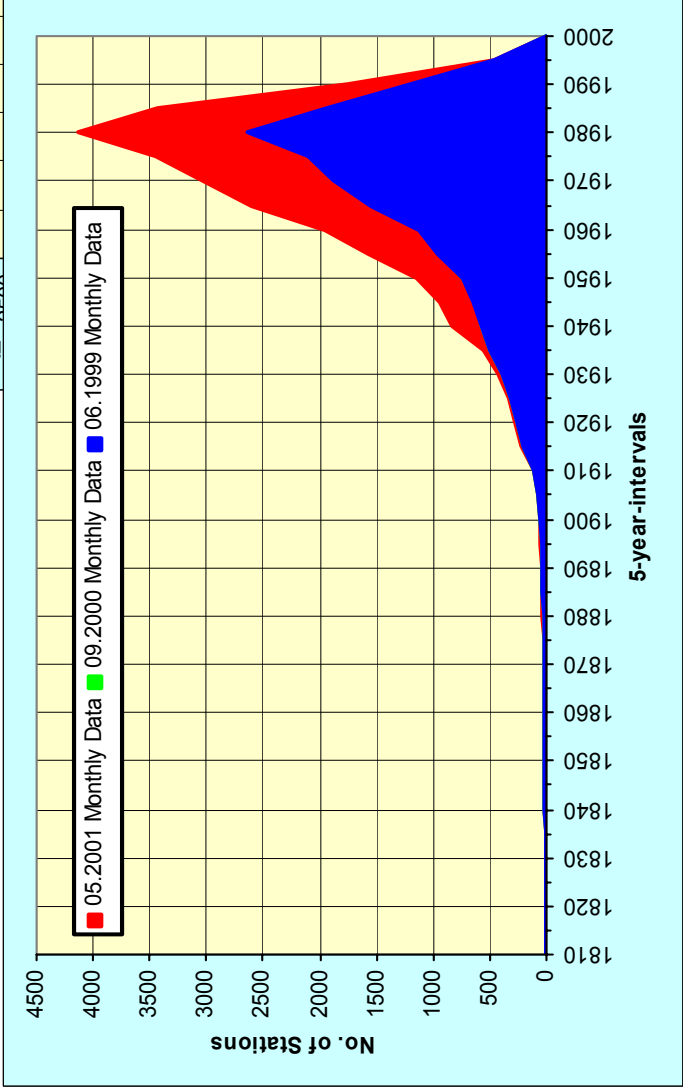


Standard services of the GRDC...



- Acquisition and processing of discharge data

Data-distribution over time

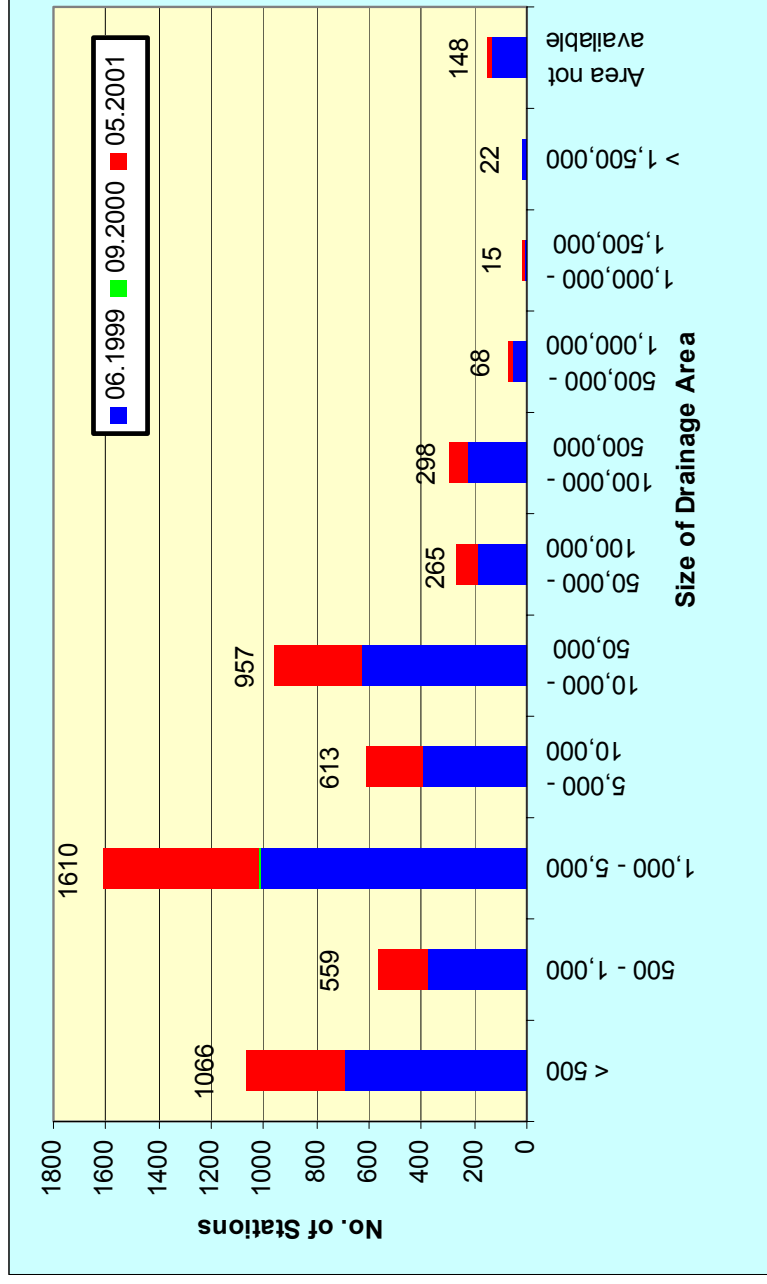


Standard services of the GRDC...



- Acquisition and processing of discharge data

Distribution of basin size for all GRDC stations



Annex 19

GRDC Data dissemination and use,

Mr. Hils

Data Dissemination Procedure



Raw Data: Personal Processing of Database Requests

- Contact via email (99 %), fax, postal mail
- Station selection by user: Database catalogue (GRDC homepage)
- Required from user: User Declaration, Project Description
- Delivery of data via email-attachment or ftp
- Invoice via postal mail
- Processing time: a few days

GRDC Steering Committee 2001 - Data Dissemination and Use

Data Dissemination Procedure

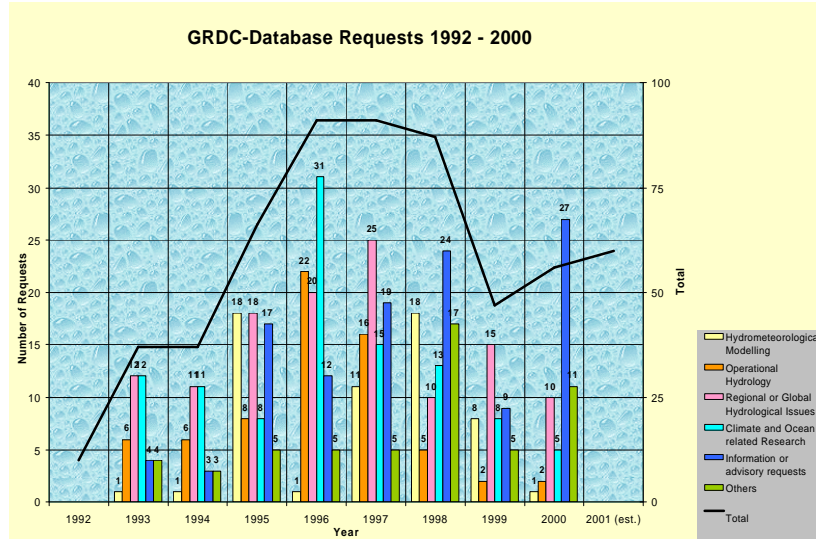


Aggregated Data, Reports: Distribution over Homepage

- User registration form in front of Download Pages
- Product 1: Freshwater Fluxes into the World Oceans (aggregated values from 197 stations)
- Product 2: Long-Term mean monthly discharges from selected stations (aggregated values from 1352 stations)
- Reports No. 22, 25, 26 - Electronic version (PDF)
- Database Catalogue

GRDC Steering Committee 2001 - Data Dissemination and Use

Number of written requests



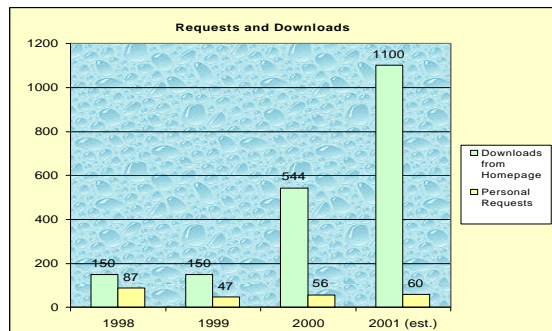
GRDC Steering Committee 2001 - Data Dissemination and Use

Type of Request



Request Type	1998	1999	2000	2001(est.)
Sending of GRDC Reports	15	10	19	
General Info, www/catalogue reference	13	1	16	
Request could not be entertained	14	7	3	
Request resulted in Data Transfer	45	29	18	
User entered Download area of homepage	150	170	544	1100

Status May-30-2001: 27 Requests, 500 Downloads



GRDC Steering Committee 2001 - Data Dissemination and Use

Annex 20

**Development of the GRDC Database
Management System, Mr. Pauler**



Johannes Pauler

responsible for ...

- Database Administration
- Database Development
- Software Development
- Technical Web Development
- Data Import

Improving the design of the GRDC database structure

Central management of all information for an easy handling and to avoid data redundancy

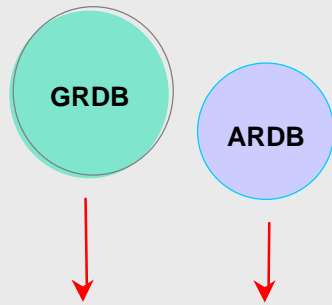
Implementation of a project management

Introduction of provisions to manage real-time and near real-time data of different parameters, e.g. water level and discharges

Documentation of the results of the quality and plausibility checks

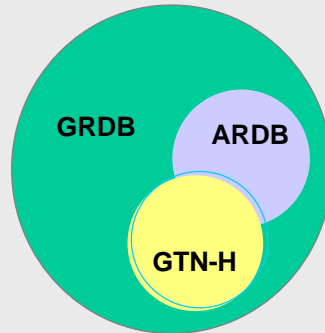
Information management in the GRDC in the view of station sets

Situation until the end of 2000



Physical **separated** databases of same design and partly of same (**redundant**) contents

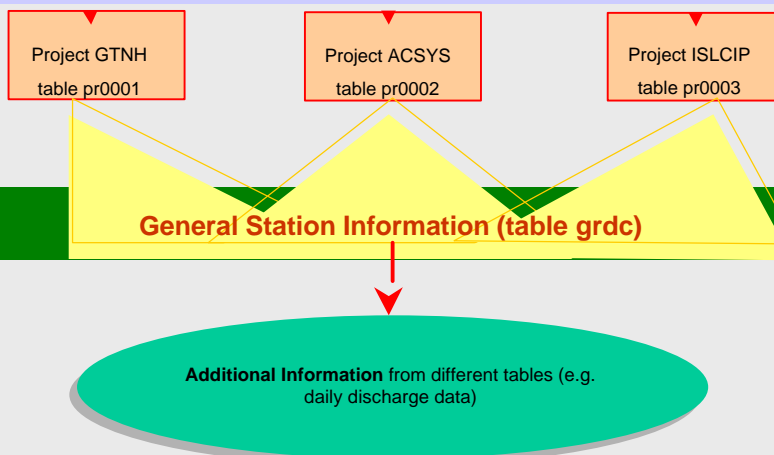
Present and future situation



One **central** database using a project management

Project management in the GRDC database

Applications querying the database, e.g. ESRI ArcView GIS



CHECKING THE GRDC STATION META-DATA

Assigning the stations to **WMO subregions** (GIS, Atlas)

Comparing the **geographic co-ordinates** (GIS, Atlas)

Eliminating **missing co-ordinates** (Atlas, TGN)

Defining the **international** (english) river name and number (TGN, Atlas)

Storing **alternative** river names (TGN, Atlas)

Fixing other **obvious errors**, if possible (e.g. basin size)

Defining the **connectivity** to the next downstream GRDC station (Atlas, GIS)

DATA CHECKS DURING UPDATES

Automated plausibility checks implemented in the GRDC Import Tool

Checking the new data against existing overlapping data

Checking the new data against existing long-term characteristics:

- » long-term monthly mean \pm standard deviation
- » long-term monthly maximum / minimum

6335050

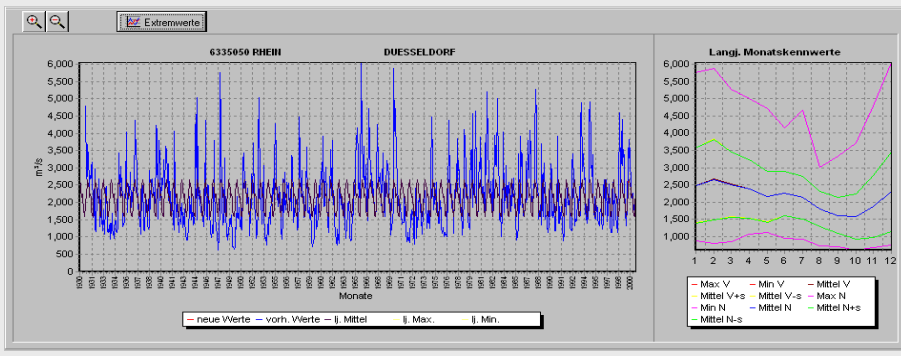
Tageswerte					Monatswerte				
Datum	Vorhanden	Neu	Abweichung	Prozent	Datum	Vorhanden	Neu	Abweichung	Prozent
1999-08-27	1770.0	1790.0	10.000	0.565	1999-08	1766.1	1766.7	0.645	0.037
1999-08-31	1700.0	1710.0	10.000	0.588	1999-09	1332.0	1320.0	-12.000	-0.901
1999-09-08	1390.0	1390.0	-10.000	-0.719	1999-10	1720.0	1718.0	-1.935	-0.113
1999-09-09	1400.0	1390.0	-10.000	-0.714	1999-12	3587.7	3499.3	-88.40	-2.464
1999-09-10	1370.0	1360.0	-10.000	-0.730					
1999-09-11	1330.0	1320.0	-10.000	-0.752					
1999-09-12	1270.0	1260.0	-10.000	-0.787					
1999-09-13	1220.0	1210.0	-10.000	-0.820					
1999-09-14	1210.0	1190.0	-20.000	-1.653					
1999-09-15	1170.0	1150.0	-20.000	-1.709					
1999-09-16	1120.0	1110.0	-10.000	-1.774					

DATA CHECKS DURING UPDATES

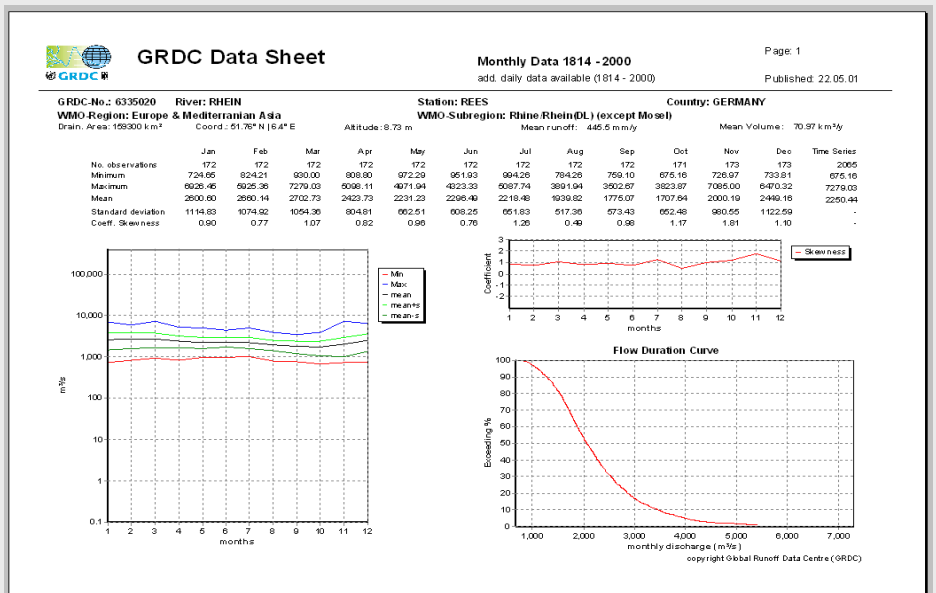
Visual plausibility checks implemented in the GRDC Import Tool

Time series graph of the new and existing data with free configurable zooming and panning options

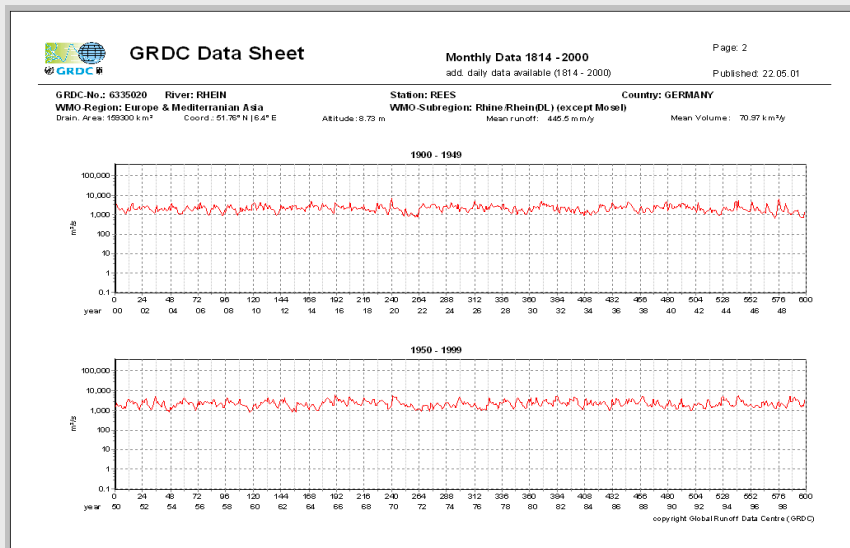
Graphs of the long-term characteristics



QUALITY CHECKING OF THE STORED DATA



TIME SERIES CURVE IN THE GRDC DATA SHEET

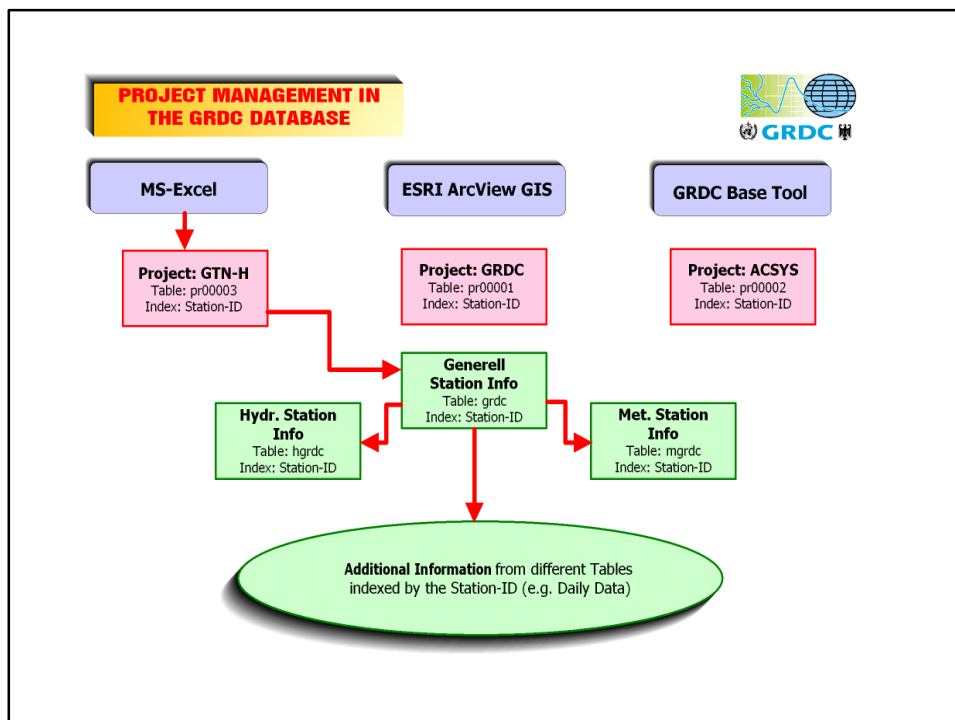
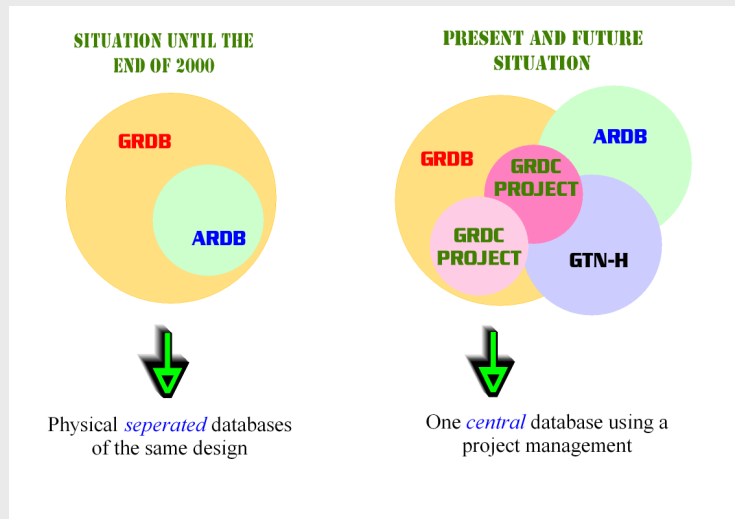


WHAT IS PLANNED FOR THE NEXT FUTURE?

- Checking the quality of the station meta-data for the WMO Regions 2, 4, 6 (4,000 stations)
- Implementation of the new database design as a test version
- Adjusting the software tools to the new database design
- Programming an improved GRDC Base Tool for user access
- Migration to the new database design



Information management in the GRDC in the view of station sets

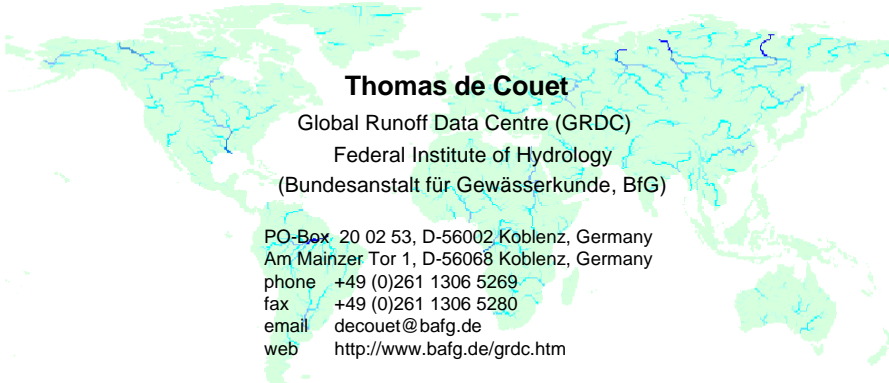


Annex 21

**Development of geographic information
system applications, Mr. de Couet**



Development of geographic information system application

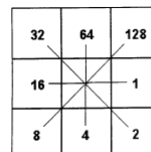


Thomas de Couet
Global Runoff Data Centre (GRDC)
Federal Institute of Hydrology
(Bundesanstalt für Gewässerkunde, BfG)

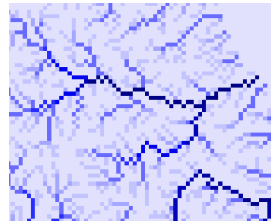
PO-Box 20 02 53, D-56002 Koblenz, Germany
Am Mainzer Tor 1, D-56068 Koblenz, Germany
phone +49 (0)261 1306 5269
fax +49 (0)261 1306 5280
email decouet@bafg.de
web <http://www.bafg.de/grdc.htm>

Conditions for computing watersheds

Flow direction Grid



Flowaccumulation Grid

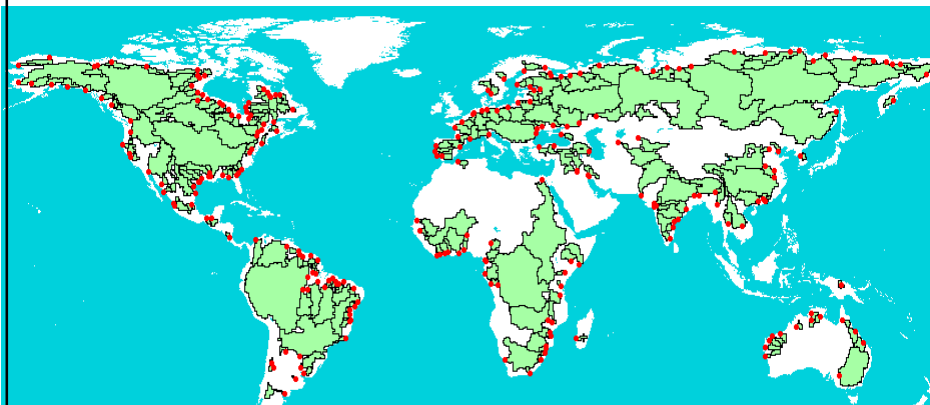


Hydrologically corrected DEM

•ETOP05 **Resolution: 0.5 deg**
47000 continental
grid cells

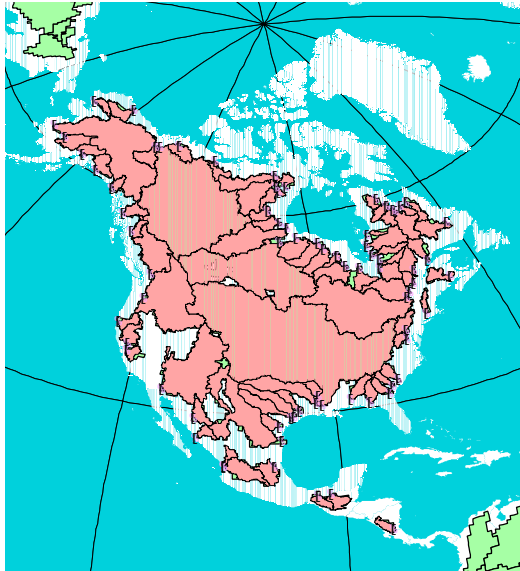
•HYDRO1K **Resolution: 30 sec**
135000000 continental
grid cells

251 calculated basins of stations close to the mouth using 0.5 deg DEM

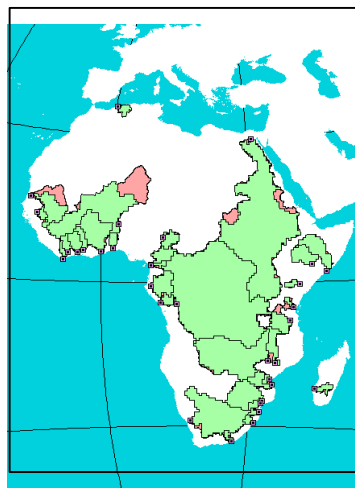
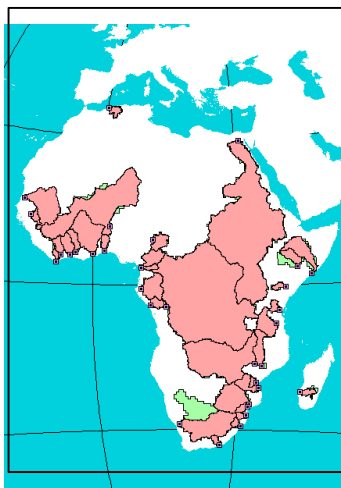


	Area of Region (1000 Km ²)	GRDC Basin Area (1000 Km ²)	Area of desert (1000 km ²)	GRDC Basin Area (%)	GRDC Basin Area (%) - Desert Area
Africa	30335	12221	8740	40.29	56.59
North an Central America	25349	13245	340	52.25	52.96
South America	17611	11866	400	67.38	68.94
Europe	10498	6450	0	61.44	61.44
Asia	43608	20018	9140	45.90	58.08
Australia	9923	2379	4730	26.65	56.74
Sum	136324	66179	23350		
Average				48.99	59.13

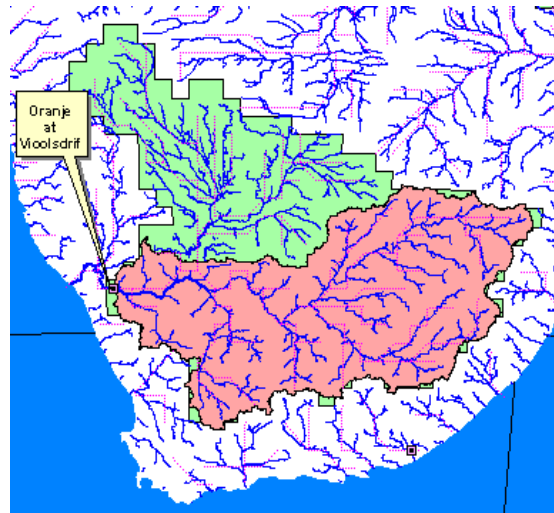
**75 calculated basins of stations
close to the mouth in North America
using 30 sec and 0.5 deg DEM**



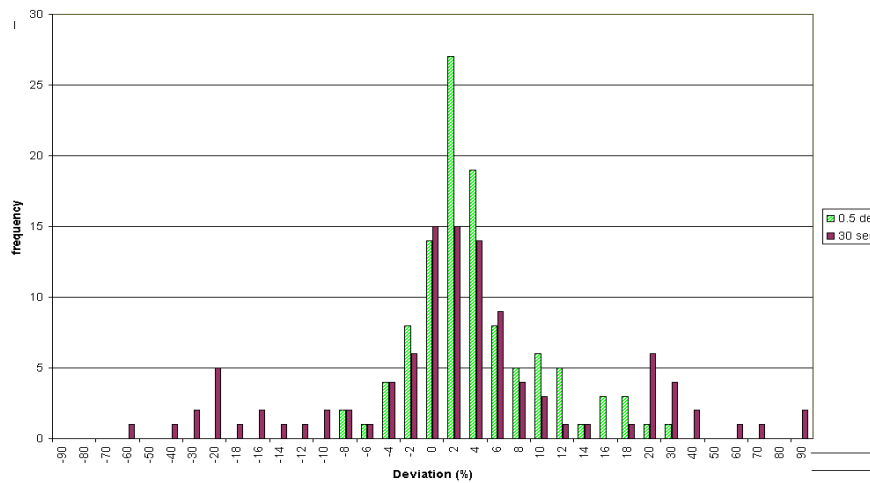
**33 calculated basins of stations
close to the mouth in Africa using
30 sec and 0.5 deg DEM**



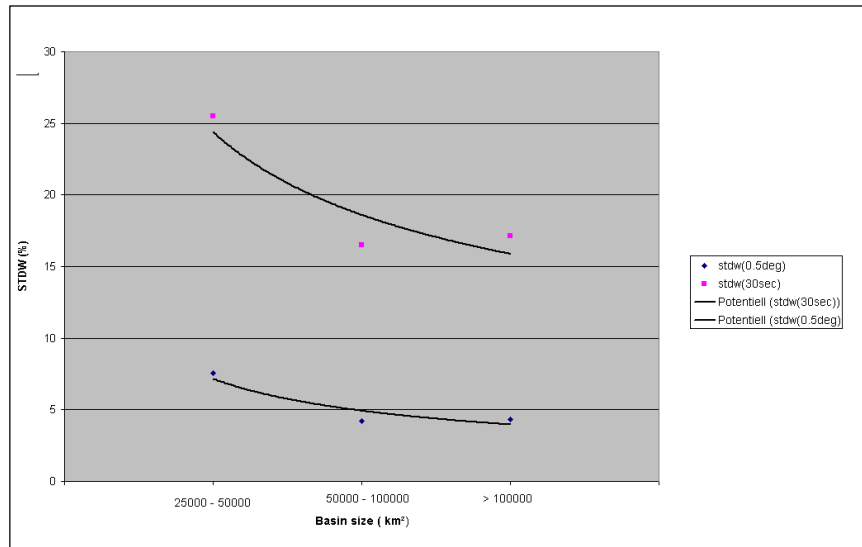
Calculated basin of Oranje river using
0.5 deg and 30 sec DEM



Histogram of difference between
DEM-calculated and GRDC basin size
from 108 selected basins



Trend of standard deviation in dependance of basin size



Analysis of results

	ETOP05/GRDC	HYDRO1K/GRDC	ETOP05/HYDRO1K	possible reasons
Difference	high	high	low	Basinarea of GRDC database suspicious
	low	high	high	HYDRO1k suspicious
	high	low	high	ETOP05 suspicious
	high	high	high	Koordinates of GRDC database suspicious
	low	low	low	Computations and metadata of GRDC OK

Intentions

Availability on internet in context with GRDC publications

Provision as input for waterbalance models

**Computation of annual runoff coefficients on using
GPCC data**

Annex 22

**Monthly Balance of Water Availability
and Water Demand in Large River Basins,
Presentation of GRDC-Report 26,
Mrs. Dornblut**



Monthly Balance of Water Availability and Water Demand in Large River Basins

Irina Dornblut

Global Runoff Data Centre (GRDC)
Federal Institute of Hydrology
(Bundesanstalt für Gewässerkunde, BfG)

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email dornblut@bafg.de
web <http://www.bafg.de/grdc.htm>

*Water Availability BA*alance in *L*arge River Basins

Water management balance

- balance **available water resources** against **anthropogenic impacts** like water uses and demands
- under consideration of their **spatial** and **temporal variation**
- based on **generally accessible data**
(GRDC, FAO, WRI, ICOLD, ...)

*Water Availability BA*lance in *L*arge River Basins

- **scaleable methodology** to evaluate the impacts of water management strategies in large river basins rapidly
- based on **measured input data**, rather than modelling physical processes
- able to track the dynamic development of sectoral components on a monthly basis (**balance monitoring**)
- capable to **support decision makers** in the water sector (as successful applications in Germany show)

*Water Availability BA*lance in *L*arge River Basins

Modelling approach

Stochastic simulation of the available water resources
(Monte-Carlo Simulation)

Deterministic consideration of basin-related anthropogenic impacts and water demands

Balancing in a **monthly time-step** along the river course

Statistical analysis of results

Water Availability Balance in Large River Basins

Large River Basins

Hydrological conditions vary with climatic and geographic factors

Vast territories shared by several countries with different economic activities and competing water uses

Systems of storage reservoirs serve different, often multiple purposes

Flow times in the system may exceed the given balancing interval

Water Availability Balance in Large River Basins

Modelling the water availability/demand balance of large river basins

Focus on the main river, the major tributaries and the major consumptive water uses

Simulation of an initial state of managed water resources

Transfer of water uses and demands from a country scale to a basin scale

Consideration of water diversions and reservoir operations

Consideration of flow times

Water Availability Balance in Large River Basins

Danube River Basin

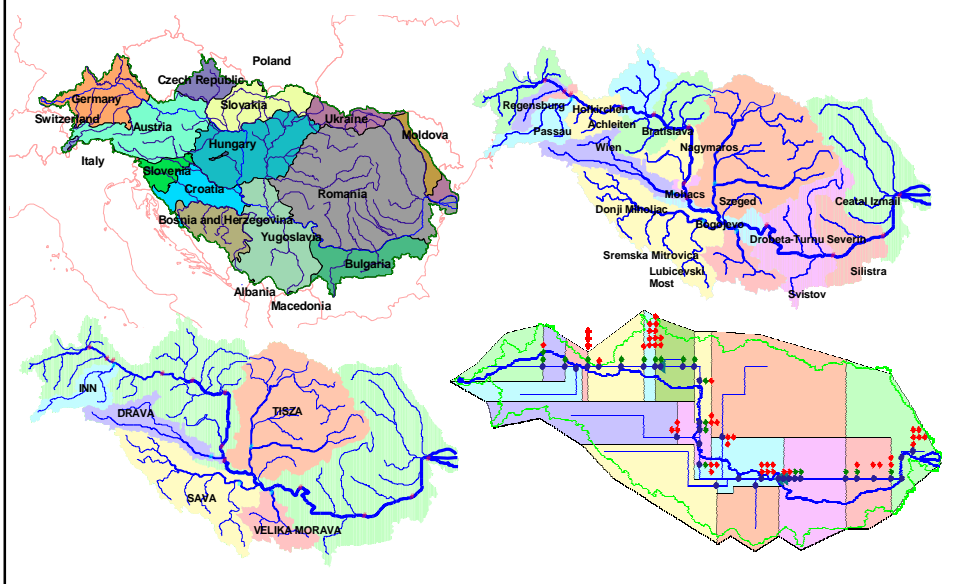
- shared between **18 countries** with different portions
- region of **intensive economic activities**
- Danube river is **navigable** nearly on its whole length
- **water shortages** in autumn and winter
- water management **affects the water quality** of the **Black Sea**

Water Availability Balance in Large River Basins

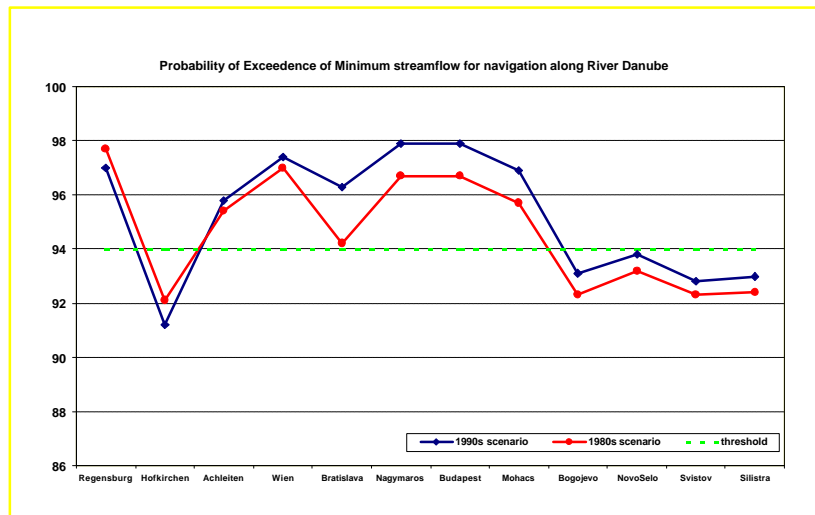
Methodological steps

- **Stochastic generation** of time-series of **monthly streamflow** based on observed streamflow for the period 1931 to 1990
- **Division** of the river basin **into sub-basins** and area-weighted **allocation** of simulated streamflow **to balancing points**
- Deterministic description of **water uses and demands on a basin scale** for different balancing horizons
- **Assignment** of water diversions, reservoirs, water uses and demands **to the respective balancing points**, with a
- **Ranking number** reflecting their significance in the river system
- **Monthly balance** and statistical analysis of results

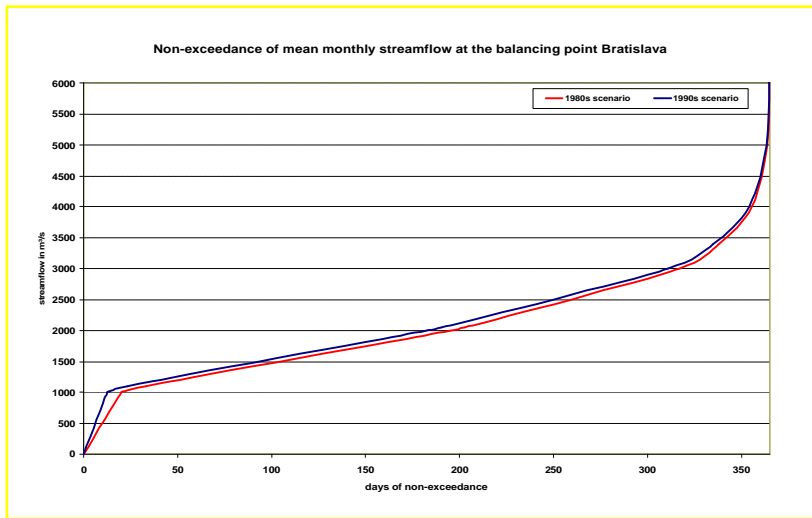
Water Availability BALance in Large River Basins
Pilot study for the Danube River



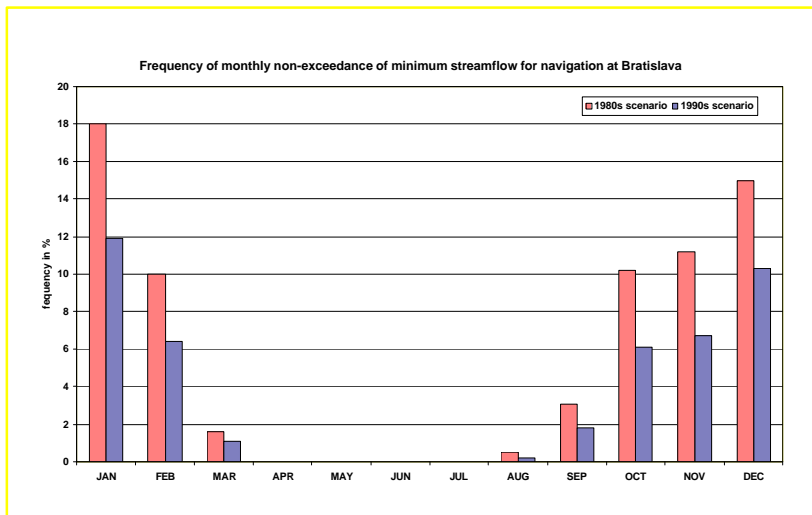
Water Availability BALance in Large River Basins
Pilot study for the Danube River - Results



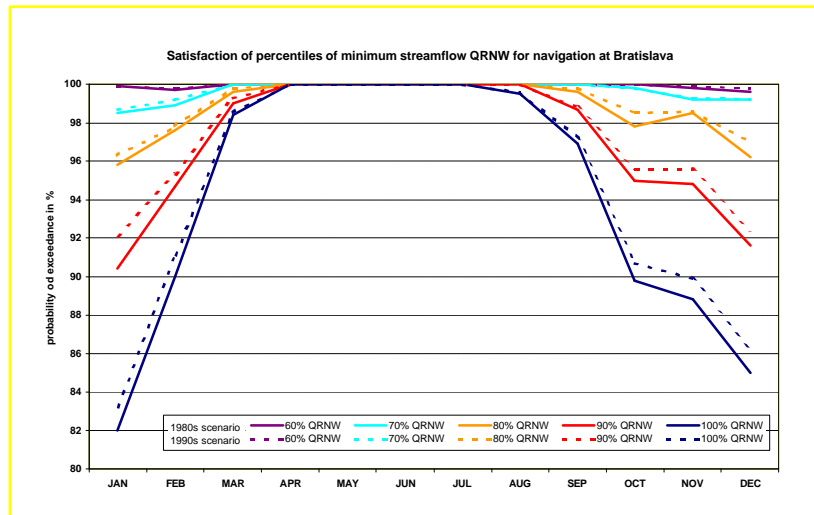
*Water Availability BA*lance in *L*arge River Basins
*P*ilot study for the Danube River - Results



*Water Availability BA*lance in *L*arge River Basins
*P*ilot study for the Danube River - Results



*Water Availability BA*lance in *L*arge River Basins
*P*ilot study for the Danube River - Results



*Water Availability BA*lance in *L*arge River Basins

Methodological set-up can be used

Monitoring the water management balance **on a regular basis** (considering updated or refined data sets)

Investigation of hypothetical scenarios

Examination of the sustainability of a given water management scheme under changing environmental conditions, alternatively

Annex 23

Station and basin related metadata,

Dr Maurer

Metadata (station specific)

GRDC stations **have** metadata

- » station specific
- » can be queried by catalogue tool

metadata can be extended, e.g.

- » annual runoff coefficient
- » next downstream gauge

GRDC Catalog Tool for Windows V 3

Queries WMO-Region WMO-Subregion GRDC-No. Country River/Station Coordinates Basin Size Time Interval

Use for Query: selected catalog last query result last saved result

GRDC-No.	River	Station	CC	Lat.	D	Lon.	D	Area	Day Ser.	MV %	Mon. Ser.	MV %	Mean Disch	Volume km ³
1134030	NIGER	BANANKORO	ML	11.68	N	-8.67	W	7175.00	1967..1992	39.5	1967..1992	48.4	913.315	28.802
1134100	NIGER	KOULIKORO	ML	12.87	N	-7.55	W	120000.	1907..1992	0.0	1907..1990	0.0	1406.731	44.363
1234150	NIGER	NIAMEY	NE	13.52	N	2.08	E	700000.	1929..1991	14.3	1929..1991	20.7	907.961	28.633
1134250	NIGER	KIRANGO AVAL	ML	13.72	N	-6.05	W	137000.	1925..1992	12.6	1925..1992	19.2	1329.367	41.923
1134400	NIGER	KE-MACINA	ML	13.95	N	-5.37	W	141000.	1953..1992	11.2	1953..1992	33.1	1372.708	43.290
1134460	NIGER	TILEMBEYA	ML	14.15	N	-4.98	W	143300.	1922..1992	18.5	1922..1992	53.3	891.292	28.108
1134500	NIGER	HOPTI	ML	14.53	N	-4.22	W	281600.	1922..1990	24.0	1922..1990	34.4	1260.386	39.748
1734500	NIGER	MALANVILLE	BJ	11.87	N	3.38	E	100000.	1922..1990	24.0	1922..1990	34.4	1260.386	39.748
1134630	NIGER (ISSA BEB)	TONKA	ML	16.13	N	-3.75	W	-9.						
1134700	NIGER	DIRE	ML	16.27	N	-3.38	W	340000.						
1134730	NIGER	KORYOUME	ML	16.67	N	-3.03	W	342000.						
1134850	NIGER	TOSSAYE	ML	16.93	N	-0.58	W	348000.						
1134900	NIGER	ANSONGO	ML	15.67	N	0.50	E	566000.						

Query for Time Interval ...

This function queries a catalog for time intervals. All stations with data between this interval will be found even if the station's time series will exceed the interval.

To query from a specified year up to the most recent year, please enter the starting year and leave the ending year blank. Queries up to a specified year work vice versa.

If the checkbox for daily data is marked then all monthly time series are ignored. Please note that the GRDC generates mean monthly discharge data from daily data.

Starting year: 1985 Ending year: 1990 Daily data only

OK Cancel

result list / 19 rows 13 stations Searching for Time Series Interval ...

Metadata (basin related)

related **documents**, stored in archive, e.g.

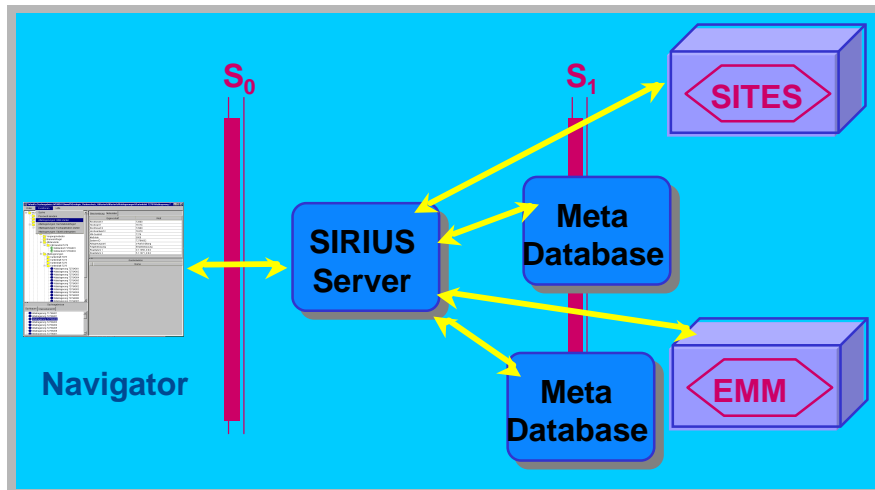
- » bookshelf (small database)
- » literature inventory (pointing to libraries)
- » use of **DMS**
 - as bitmap
 - machine readable text
 - > abstracts / complete text
 - > full text search
 - > automated indexing using a thesaurus

Metadata (basin related)

available digital datasets of various sources

- » collecting related datasets (“mirror-site”)
- » pointing to related datasets elsewhere
 - collecting their metadata and hyperlinks
 - pointing to their metadatasets
 - > need to conform with a given standard
 - > can be viewed by “integrating tools”

Example: Software SIRIUS



SIRIUS: User interface

- Data Catalog
- Meta Data
- Crosslinks
- Search result tree
- Factual viewer
- Geo viewer


The screenshot shows the SIRIUS user interface. On the left is a search result tree with a tree view and a list view. The list view shows search results for 'Altablagung' with various IDs. The main window displays a metadata table for a selected result. A red circle highlights a map view (Geo viewer) showing a detailed site plan.

Beschreibung	Eigenschaft	Wert
Rechtswert 1		72800
Hochwert 1		76174
Rechtswert 2		72909
Hochwert 2		76270
KM-Quadrat		7276
Maßstab		5000
System-ID		7276A002
Ablagerungsart		a-Aufschüttung
Folgebebauung		Einzelbebauung
Realdatum 1		01.1956, 0,0,0
Realdatum 2		1957, 0,0,0


```

<?xml version="1.0" encoding="iso-8859-1" ?>
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- <x_tags>
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- <[[CDATA[ 20010521 155236 ]]]>
</Creation_datetime>
- <Creation_IP>
- <[[CDATA[ 206.246.119.21 ]]]>
</Creation_IP>
- <DTD_version>
- <[[CDATA[ metadata15.dtd ]]]>
</DTD_version>
- <OME_version>
- <[[CDATA[ Version 2.0.25a, Revision Date: 06 Jun 2001 ]]]>
</OME_version>
- <File_revision>
- <[[CDATA[ 20010611 115724 ]]]>
</File_revision>
- <Data_Originator>
- <Investigator>
- <Name>
- <[[CDATA[ Maurer, Dr. Thomas ]]]>
</Name>
- <Email>
- <[[CDATA[ thomas.maurer@bafg.de ]]]>
</Email>
</Investigator>
- <Metadata_Author>
- <Name>
- <[[CDATA[ Curtis, Carroll ]]]>
</Name>
- <Email>
- <[[CDATA[ encurtis@crosslink.net ]]]>
</Email>
- <Phone>
- <[[CDATA[ +1-804-769-2495 ]]]>
</Phone>
</Metadata_Author>
</Data_Originator>
- <Data_Set_Information>
- <Data_Set_Title>
- <[[CDATA[ Global Runoff Data Base (GRDC Datasets) ]]]>
</Data_Set_Title>
</Project />
- <Site_Information>
- <Site>
- <[[CDATA[ Global (point) ]]]>
</Site>

```



ORNL DAAC Mercury Metadata Report



[Help](#)

Title: Global Runoff Data Base (GRDC Datasets)

Project(s): Maurer, Dr. Thomas Email: thomas.maurer@bafg.de

Investigator(s): Maurer, Dr. Thomas Email: thomas.maurer@bafg.de

Status: Final (with updates when available)

Access Restrictions: See Abstract about GRDC Data Policy

Data Set Location: Global Runoff Data Centre (GRDC), Federal Institute of Hydrology, Koblenz, Federal Republic of Germany

Data Center Contact: Maurer, Dr. Thomas Email: thomas.maurer@bafg.de Phone: +49-261-1306-5224

Data Center URL: <http://www.bafg.de/grdc.htm>

Data Set Citation: Global Runoff Data Base (GRDC Datasets), Global Runoff Data Centre (GRDC), Federal Institute of Hydrology, Koblenz, Federal Republic of Germany.

Download Data Set(s): [Download Area of the GRDC Data Products, Catalogue Tool, and Reports](#)
 Note: For statistical purposes, networking, and feed-back to data providers, the GRDC requests users' name and email address to enter the download area. All products listed here are available on CD/diskette, too. Please mail the GRDC (grdc@bafg.de) for your request. The downloaded products are free for use under the restriction to add acknowledgement to the publications they are used for.

[Download GRDC Station Catalog](#)
 Note: There is also available for downloading a Catalogue Tool (for Win32 users) to allow for easy exploration of the flat ASCII-table, including some documentation. To access the Catalogue Tool, go to http://www.bafg.de/html/internat/grdc/download_target.html and provide name and email address to connect to GRDC Download Area.

Parameter Description:

Parameter	Sensor	Source	Term	Topic
RIVERS/STREAMS			SURFACE WATER	HYDROSPHERE
DISCHARGE/FLOW	STREAM GAUGE	STREAMFLOW STATION	SURFACE WATER	HYDROSPHERE
RUNOFF			SURFACE WATER	HYDROSPHERE

Keyword(s): Discharge
 Inland seas
 Hydroclimatology Collections
 Oceans
 Rivers
 Runoff
 Streamflow
 Surface water

Abstract: The Global Runoff Data Centre (GRDC) operates with the support of the Federal Republic of Germany under the auspices of the World Meteorological Organization (WMO) within the Federal Institute of Hydrology (BfG). The principal objective of the GRDC is to collect and disseminate hydrological data to support projects within the World Climate Programme (WCP) and the World Climate Research

The GRDC database is continuously updated with contributions of data from over 150 countries. The database now (May 2001) comprises 2533 stations of daily data featuring 70,000 station-years (25 million data points) and 5621 stations of monthly data featuring 160,000 station-years (1.9 million data points). The average time series length is 27 years.

On request, data products are developed and specialized databases are assembled by the GRDC for projects both on regional and global scale. Due to GRDC's data policy of unrestricted but identified access, limited to non-commercial applications, the original GRDC data are presently not available online. (See Data Policy at <http://www.bafg.de/html/internet/grdc/policy.htm>.) Instead, an applicant has to identify himself and his purpose and to agree upon the data policy by signing a declaration (which can be sent by fax). Also, it is not possible for the GRDC to deliver the entire database. This data policy takes into account the considerable reluctance of some data providers to let their data circulate freely 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 by mailing floppy disks, if the requester does not provide an email address. Users can request monthly or daily discharge data which they may comfortably select using the so-called catalogue tool which is freely available from the download section of the webpage of the Centre.

The data themselves are free of charge and the user is charged only for the reproduction costs. The minimum charge is DM 75.00, which should be sufficient for a request up to 10 or 15 stations under normal circumstances. For information on ordering river discharge data, see detailed ordering instructions and steps to obtain data at <http://www.bafg.de/html/internet/grdc/steps.html>.

While it is not possible to obtain the entire database, GRDC now provides two web-based data products from aggregated data sets with global coverage. These datasets are available on CD-ROM and on the Internet for downloading.

Freshwater Surface Water Fluxes in the World Oceans, Marginal and Inland Seas (v 1.0)

This data set enlarges and updates GRDC's 1996 calculations of surface water fluxes into the world oceans. The data product contains information from 153 river gauging stations draining into the World Oceans (Arctic, Atlantic, Indian and Pacific oceans) and 16 river gauging stations draining into inland and marginal seas such as: the Mediterranean, Persian Gulf, North Sea, Baltic Sea, Caspian Sea, Black Sea and Aral Lake. This data product is based on mean monthly discharge in cubic metres per second. Gauging stations close to the mouth of rivers draining into the oceans or marginal and inland seas with a basin area larger than 5,000 square kilometers were selected. Fifty percent of the time series used are longer than 20 years. Stations with shorter time series were included also to produce a comprehensive data set. For 30% of the selected stations, the percentage of missing values in the time series is more than 10%. For background information on this dataset, see <http://www.bafg.de/html/internet/grdc/projects/199stat/introtdt01.html>.

Long Term Mean Monthly Discharges of Selected GRDC Stations (v 1.0)

This dataset is a subset of 1352 stations from the GRDC station catalog which provides long term monthly average discharges for selected rivers. Selection criteria includes: 1) data available at a minimum of 10 years without missing values; and 2) stations with a drainage area of more than 2500 km.

Site Information:


Site	Bounding Coordinates				
	N	S	E	W	
Global(point)	90	-90	180	-180	

Content Time Range: Begin: 19070101 - End:

Metadata Author: Curtis, Carroll Email: cncurtis@crosslink.net Phone: +1-804-769-2495

Metadata Source: http://www-nsodis.ornl.gov/data/bluannel_harvest/EGED/curtis/metadata/hydrology/grdc.xml

Additional Documentation: [GRDC Data Product Descriptions](#)



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BIOSPHERE
[Vegetation](#) - [Wetlands](#) - [Zoology](#) - [more ...](#)

CRYOSPHERE
[Sea Ice](#) - [Snow Cover](#) - [Glaciers](#) - [more ...](#)

HUMAN DIMENSIONS
[Human Health](#) - [Environmental Impacts](#) - [more ...](#)

HYDROSPHERE
[Water Quality](#) - [Ground Water](#) - [more ...](#)

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[Arctic](#) - [Countries](#) - [Troposphere](#) - [more ...](#)

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[Land Use / Land Cover](#) - [Soils](#) - [more ...](#)

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[Temperature](#) - [Circulation](#) - [Coastal Processes](#) - [more ...](#)

PALEOCLIMATE
[Ice Cores](#) - [Tree Rings](#) - [more ...](#)

RADIANCE / IMAGERY
[RADAR](#) - [Infrared Wavelengths](#) - [more ...](#)

SOLAR-TERRESTRIAL INTERACTIONS
[Solar Activity](#) - [Sunspots](#) - [more ...](#)

SOLID EARTH
[Volcanoes](#) - [Rocks / Minerals](#) - [more ...](#)

INSTRUMENTS
[Thermometers](#) - [Stream Gauge](#) - [more ...](#)

PROJECTS
[BOREAS](#) - [BOSDIS](#) - [TOGA COARE](#) - [more ...](#)

What's New

Earth Science Services (Beta Release)

- New Metadata Authoring Tool
- ESIP Free-text Search
- IPCC Third Assessment Report on Climate Change Released 1/20/2001
- New Data Sets for May, 2001
- Send Me Data Updates
- GCMD Keyword Lists

Earth Science Resources

- Earth Science Links
- Learning Center
- Climate Change Web Highlights for June 2001
- Global Change Data and Information System (GCIDS)
- Conference Calendar
- GCMD FAQs

Other Search Interfaces

- Free-Text Search
- JAVA Matrix Interface

Search the GCMD for Earth Science Data Sets by Parameters

Text search across topic of **HYDROSPHERE:**

HYDROSPHERE : GROUND WATER

AQUIFERS (10) **i**
 DISCHARGE/FLOW (19) **i**
 DISPERSION (2) **i**
 DRAINAGE (9) **i**
 GROUNDWATER CHEMISTRY (46) **i**

INFILTRATION (19) **i**
 LAND SUBSIDENCE (4) **i**
 PERCOLATION (2) **i**
 SALTWATER INTRUSION (4) **i**
 SPRINGS (10) **i**
 WATER TABLE (22) **i**

HYDROSPHERE : SNOW/ICE

ABLATION (2) **i**
 ALBEDO (17) **i**
 AVALANCHE (2) **i**
 FREEZETHAW (19) **i**
 FROST (9) **i**
 GLACIERS (7) **i**
 ICE DEPTH/THICKNESS (18) **i**
 ICE EXTENT (51) **i**
 ICE GROWTH/MELT (9) **i**
 ICE MOTION (2) **i**
 ICE SHEET ELEVATION (11) **i**
 ICE SHEETS (24) **i**

ICE VELOCITY (6) **i**
 LAKE ICE (28) **i**
 PERMAFROST (10) **i**
 RIVER ICE (14) **i**
 SNOW COVER (124) **i**
 SNOW DENSITY (15) **i**
 SNOW DEPTH (94) **i**
 SNOW ENERGY BALANCE (4) **i**
 SNOW FACIES (2) **i**
 SNOW MELT (5) **i**
 SNOW WATER EQUIVALENT (30) **i**
 SNOW/ICE TEMPERATURE (22) **i**

HYDROSPHERE : SURFACE WATER

AQUIFER RECHARGE (2) **i**
 DISCHARGE/FLOW (101) **i**
 DRAINAGE (39) **i**
 FLOODS (44) **i**
 HYDRO PATTERN (9) **i**
 HYDROPERIOD (2) **i**
 INUNDATION (6) **i**
 LAKES (238) **i**

RIVERS/STREAMS (314) **i**
 RUNOFF (87) **i**
 STAGE HEIGHT (24) **i**
 STREAM CHEMISTRY (28) **i**
 TOTAL SURFACE WATER (15) **i**
 WATER CHANNELS (10) **i**
 WATER DEPTH (22) **i**
 WATER YIELD (7) **i**
 WETLANDS (140) **i**

HYDROSPHERE : WATER QUALITY

ACID DEPOSITION (28) **i**
 ALKALINITY (27) **i**
 BENTHIC INDEX (9) **i**
 CARBON DIOXIDE (1) **i**

NITROGEN COMPOUNDS (32) **i**
 NUTRIENTS (41) **i**
 ORGANIC MATTER (47) **i**
 OXYGEN TEST **i**

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Results for: **HYDROSPHERE.SURFACE WATER.RUNOFF** (Refinement by **DISCHARGE/FLOW**)

13. [Marcell Experimental Forest Water Chemistry](#)

14. [Meteorological, Hydrological, and Oceanic Data for the Entire Russian Continent Residing in Numerous Hardcopy Volumes \(1700-1962\)](#)

15. [Monthly Discharge Data from the Global Runoff Data Center \(GRDC\), Federal Institute of Hydrology, Koblenz, Germany](#)

16. [Precipitation and Runoff in East German River Basins \(1866-1900\)](#)

17. [Rainfall, Runoff and River Flow Time Series Data From the Institute of Hydrology, United Kingdom](#)

18. [Real-Time Water Data from the USGS Water Resources Division](#)

19. [Runoff Analysis Using Multiple Isotope Tracers in the Iwamu River Drainage, Akita, Japan](#)

20. [Storage and Retrieval of U.S. Waterways Parametric Data \(STORET\)](#)

21. [The AVI Project Directed by the Department of Civil Protection to the National Group for Prevention of Hydrological Hazards \(GND/CI\)](#)

22. [The Global Energy and Water Cycle](#)

Precipitation and Runoff in East German River Basins (1866-1900)

CONTENTS - [Summary](#) - [Coverage](#) - [Attributes](#) - [Distribution](#) - [Personnel](#) - [Supplemental Info.](#)

Summary

1996-09-10

The runoff and precipitation data resides in 1 book, 'Die Niederschlags-und-Abflussverhältnisse im Gebiet der Weisseritz während der Jahre 1866 bis 1900' (C/dc 320 Ma) written in German. The data contained in this book are tables of monthly and annual precipitation and runoff from river basins in East Germany. These data are for the period 1866 to 1900. Parameters for each individual month and year and averaged over the period are precipitation total and runoff. Streamflow values and water output are measured for each individual month.

This book is part of the foreign meteorological data collection held by the NOAA Central Library in Washington, DC. Information in this collection dates back to the 18th century for daily, monthly, seasonal, and annual tabular summaries, and the 19th century for weather maps. These data are the result of foreign exchange agreements, but the collection has not been updated since 1983.

Coverage

TEMPORAL COVERAGE

Start Date Stop Date

Annex 24

**Prototype of a document meta-database
for the Danube river basin, Mrs. Dornblut**

Metadata and databases: Current activities at GRDC

Global Runoff Data Centre
Federal Institute of Hydrology (BfG), Koblenz, Germany

Irina Dornblut

Summary of presentation

Metadata are fundamental to make the use of data effective. They are the key to discovery and selection of data. The main question to answer is: What information is provided for whom, in which form, and what does this cost?

Answering this question GRDC has taken some efforts to check the possibilities to built up a discharge-related metadata service at GRDC. GRDC already provide metadata like the site and time series information related to the gauging stations and offered in GRDC's catalogue tool on the web. This station-related metadata could be extended by some hydrological basic information or statistics, possibly.

The preparation of basin-related metadata takes a great deal of time and intellectual input for discovery, extraction, documentation, archiving as presupposes of an effective information retrieval. Based on the experiences with the documentation of the data and information used for the pilot study for the water management balance of the Danube River the efforts of metadata mining and preparing are estimated roughly.

For this study approx. 100 documents (literature in a wider sense) are stored in a Document Management System, using Optical Character Recognition (OCR) if possible and currently actualised term lists (like thesauri) and archiving the original data sources (tables, images, PDF-files, Word-files, scanned text). The content-orientated structure of the archiving system focused on the description of basin-related water resources management.

For the estimation of time and staff three types of documents were defined. Assuming 180 minutes to per document to be the maximum time for discovery, extraction, description and archiving and a sufficient description of a basin by approx. 100 documents, the time for documentation for the 200 most important river basins reaches a maximum of 40 man-years. Assuming only 45 minutes per document, the required time for documentation still will amount to 10 man-years.

Following are attached some slights, presented at the session on metadata and databases at the 5th GRDC-Steering Committee meeting as background for further discussions.

Metadata



"**data about data**" describe the content, quality, condition, and other characteristics of data (FGDC-STD-001-1998)^{***}

The information and documentation which makes data sets **understandable** and **shareable** for users (ISO 11179, 1995)

Data associated with objects which **relieves** their potential users **of having to have full advance knowledge** of their existence or characteristics (from Project DESIRE)^{*}

Information which allows the **intelligent and effective access of data** as well as their administration ^{**}

* DESIRE - Development of a European Service for Information on Research and Education/ UKOLN - UK Office for Library and Information Networking

** Moßgraber, J.: Konzeption, Entwurf und Umsetzung eines Metadatenmodells zur Interpretation und Verwaltung von Informationen mit geographischem Bezug, Karlsruhe 1997

*** Content Standard for Digital Geospatial Metadata / The Federal Geographic Data Committee, June 1998

Metadata



Fundamental to make the use of data more effective

Key to discovery and selection of data

Reduction of time for searching

Evaluation of data and information
(usability, fitness and quality, access and transfer)

The need for metadata services for aggregation and interchangeability of information is already clear

Metadata



What kind of information

Metadata structure, Classification, Indexing, Description format

will be provided for whom

Retrieval techniques, Discovery tools, Completeness and Precision, User profiles

in which form and

Output format, Collection and Archiving, Access and Transfer, Administration

what does this cost?

Intellectual input, Automation, Standardisation (Thesauri, Dublin Core, ISO, ...)

Metadata

GRDC-Ref	Item	DocTitle	DocType
6441100	MAWA	WISARTICARY	CC 49
6441100	MAWA	L180	AT 49
6441100	DATA	DATAKARTI	PT 49
6441100	DAWBER	DAWBER	PT 49
6441100	PROT	PROT	CC 49
6441100	MAWA	WISARTICIA	CC 49
6441100	MAWA	WISARTICARY	CC 49
6441100	DAWBER	DAWBER	PT 49
6441100	SCARAB	SCARAB	PT 49
6441100	ELLES	ELLES	PT 49

Sites Providing Hydrologic Information

Metadata



Metadata Services presuppose Documentation

Discovery of data and information,
Searching in databases

Extraction, Description, Classification,
Indexing of data and information

Aggregation of information,
Integration in 'metadatabases',
Archiving and Administration

Take up a great deal of time and intellectual input

Metadata

Documentation of the information resources used for the water management balance of the Danube River

- approx. 100 documents (literature in a wider sense)
- stored in a Data Management System (available at FIH)
- using Optical Character Recognition (OCR) if possible
- using term lists (like thesauri), actualised currently
- archiving the originals (tables, images, PDF, Word-doc, scanned text)

- ➡ content-orientated structure of the archiving system focused on the description of basin-related water resources management
- ➡ documentation fields for documentation as well as an effective retrieval (bibliographically)

Metadata

**content-orientated structure of the archiving system
focused on description of basin-related water management**

- | | |
|-----------------------|-------------------------------|
| 1. Climate | 5. Water use |
| 2. Hydrological cycle | 6. Water resources management |
| 3. Surface water | 7. Water policy and law |
| 4. Groundwater | 8. Agencies |

Metadata

**documentation fields for an effective retrieval,
focused bibliographically**

- | | |
|------------------------|-----------------------------------|
| 1. Author | 10. River/Basin (term list) |
| 2. Editor | 11. Country (term list) |
| 3. Title | 12. WMO Region (term list) |
| 4. Additional title | 13. Keywords (term list) |
| 5. Book title | 14. Source/Provider |
| 6. Journal | 15. Date of entry (automatically) |
| 7. Year of publication | 16. Notes/Abstract |
| 8. Volume | 17. Language (term list) |
| 9. Pages | |

Metadata

Types of documents:

	Discovery	Extraction download/print copy/scan	Description, Indexing bibliographic indexing	Aggregation; Archiving	summ.
	minutes	minutes	minutes	minutes	minutes
1	15	5	15	5	40
2	15	10	30	10	65
3	15	30	120	15	120

OCR
automated indexing
simple matters

OCR
manuell indexing using
thesauri
demanding scientific
content

No OCR applicable
manuell indexing
demanding, highly scientific
content

Metadata

The screenshot shows the 'Mappenmanager' software interface. The main window is titled 'Mappenmanager: Archivübergreifende Suche in STANDARD - SURFACEW und weiteren'. It features a menu bar with 'Datei', 'Bearbeiten', 'Ansicht', 'Dokument', 'Suche', 'Extras', and 'Hilfe'. Below the menu bar is a toolbar with icons for 'Hilfe', 'Info', 'Beenden', 'Treffer', 'Glossar', and 'Archiv'. The main area contains search filters: 'Volltext' (empty), 'Country' (dropdown), 'River/Basin' (dropdown), 'WMO Region' (list box with 'DANUBE' selected), 'Keywords' (list box with 'DANUBE (DONAU)', 'DANUBE (DUNA)', 'DAPTAN', 'DARENT', 'DARGOL'), and 'Language' (dropdown). A sidebar on the left shows 'Archiv', 'Suche', 'Trefferliste', and 'Mappe' buttons. A bottom sidebar shows 'STANDARD' and 'GRDC' buttons. A right sidebar shows an 'Archiv' list with items like 'WATERUSE', 'AGENCIES', 'CLIMATE', 'GROUNDW', 'HYDCYCLE', 'POLILAW', 'RESMANAG', and 'SURFACEW'. At the bottom right, there are four 'STANDARD' buttons.

Metadata

Metadata Form:

- Author: MINISTRY OF ENVIRONMENT, MINISTRY OF TRANSPORT, COMMUNICATION AND WATER MANAGEMENT
- Editor: ICPDR
- Title: NATIONAL REVIEWS 1998 HUNGARY
- Additional Title: EXECUTIVE SUMMARY
- Book Title:
- Series Title: DANUBE POLLUTION REDUCTION PROGRAMME
- Journal:
- Year of publication: 2000
- Volume:
- Pages: 62
- River/Basin: DANUBE
- Country: HUNGARY
- WMO Region: EUROPE
- Keywords: IKSD; WATER RESOURCES; WATER MANAGEMENT
- Source/Provider: www.icpdr.org

Document Viewer:

DANUBE POLLUTION REDUCTION PROGRAMME

**NATIONAL REVIEWS 1998
HUNGARY**

Mappenmanager: Archivübergreifende Suche, 46 Treffer, aktuelles Archiv: STANDARD - SURFACEW

Archiv	LiqNr	Archivdatum	Author	Editor	Title	Additional Title	Year of publication	Language
STANDARD	1	06.06.01	Jovicic, M., Bogdanovic, B.		UTILIZATION OF WATER FOR OTHER F		1994	ENGLISH
	2	06.06.01	Jovicic, M., Jankovic, D., B		UTILIZATION OF THE DANUBE WATER		1994	ENGLISH
	3	06.06.01		Draga V. Jankovic, Milja Z. Jovicic	THE DANUBE IN YUGOSLAVIA	contamination, protection and	1994	ENGLISH
	4	06.06.01	Pal Benedek, Attila Darasz,		THE EFFECT OF BUDAPEST ON THE W.		1994	ENGLISH
	5	31.05.01		ICPDR	Hydroengineering	Major Hydraulic Structures ar	2001	ENGLISH
	6	31.05.01		Food and Agricultural Organization	Moldova		1998	ENGLISH
	7	31.05.01		Food and Agricultural Organization	FAODSTAT Agricultural Data	Land Use, Irrigation, Populati	2000	english
	8	31.05.01		Food and Agricultural Organization	Ukraine		1998	english
	9	30.05.01		WWF Österreich	TODESFALLE KRAFTWERK SCHÜTT	Jährliches Huchen-Sterben z	1999	GERMAN
	10	30.05.01		WWF und DOPPS BirdLife Slovenia	Neues Leben für die Mur	WWF und DOPPS BirdLife S	2001	ENGLISH
	11	30.05.01	Birgit Wolf		Miteinander arbeiten, voneinander lernen		2000	GERMAN
	12	29.05.01	Hellmut Fleckseder	BUNDESAMT FÜR WASSERWIRTSCHAFT	Internationale Bemühungen zum Schutz de		1997	GERMAN
	GRDC	13	29.05.01	MINISTRY OF ENVIRONM	ICPDR	NATIONAL REVIEWS 1998 CZECH REPUBLIC	EXECUTIVE SUMMARY	2000
14		29.05.01	Anselm FRANZ		Slowakische Republik: Neuordnung der W		2000	GERMAN
15		29.05.01	NATIONAL ACADEMY OF	ICPDR	NATIONAL REVIEWS 1998 MOLDOVA	EXECUTIVE SUMMARY	2000	ENGLISH
16		29.05.01	ISTVAN UJAS; LAJOS SZLÁVIK		WATER RESOURCES MANAGEMENT IN		2000	ENGLISH
17		29.05.01	MINISTRY OF ENVIRONM	ICPDR	NATIONAL REVIEWS 1998 HUNGARY	EXECUTIVE SUMMARY	2000	ENGLISH
18		29.05.01	K.HOFIUS		CO-OPERATION IN HYDROLOGY OF TH		1991	ENGLISH
19		29.05.01	MINISTRY OF AGRICULT	ICPDR	NATIONAL REVIEWS 1998 BOSNIA AND EXECUTIVE SUMMARY		2000	ENGLISH
20		29.05.01	MINISTRY OF ENVIRONM	ICPDR	NATIONAL REVIEWS 1998 SLOVAKIA	EXECUTIVE SUMMARY	2000	ENGLISH
21		29.05.01	MINISTRY OF WATERS, F	ICPDR	NATIONAL REVIEWS 1998 ROMANIA	EXECUTIVE SUMMARY	2000	ENGLISH
22		29.05.01		FRANCI STEINMAN; PRIMOZ BANDOVEC	WATER RESOURCES MANAGEMENT IN		2000	ENGLISH
23		29.05.01		SVATOPLUK MATULA; MIROSLAV KRÁL	WATER RESOURCES MANAGEMENT IN		2000	ENGLISH
24		29.05.01	STATE WATER DIRECTO	ICPDR	NATIONAL REVIEWS 1998 CROATIA	EXECUTIVE SUMMARY	2000	ENGLISH
25		29.05.01	MINISTRY OF ENVIRONM	ICPDR	NATIONAL REVIEWS 1998 SLOVENIA	EXECUTIVE SUMMARY	2000	ENGLISH
26		28.05.01		Regionale Zusammenarbeit der Donauländ	TEMPERATUR- UND EISREGIME DER D		1993	GERMAN
27		28.05.01		Regionale Zusammenarbeit der Donauländ	SCHWEBSTOFF- UND GESCHIEBEREGI		1993	GERMAN
28	28.05.01		Regionale Zusammenarbeit der Donauländ	Die Donau (und ihr Einzugsgebiet	Eine hydrologische Monogra	1986	GERMAN	

Metadata

Felder (19/17) | Dokumente (1/1)

Author: _____

Editor: Food and Agricultural Organization

Title: FAOSTAT Agricultural Data

Additional Title: Land Use, Irrigation, Population 1990-1998

Book Title: _____

Series Title: _____

Journal: _____

Year of publication: 2000

Volume: _____

Pages: _____

River/Basin: DANUBE

Country: AUSTRIA; BOSNIA AND HERZEGOVINA; BULGARIA

WMD Region: EUROPE

Keywords: IRRIGATION; POPULATION; LAND USE; DATA

Felder (19/17) | Dokumente (1/1)

344 Records © Copyright FAO 1990-1998

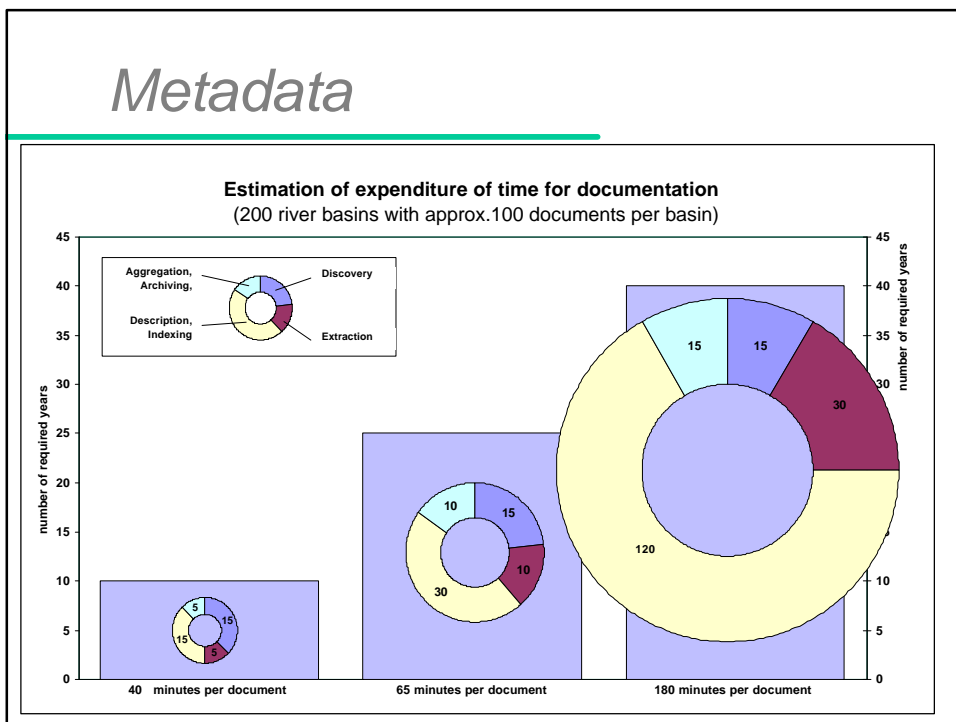
Land Use
Total Area (1000Ha)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Austria	8,386	8,386	8,386	8,386	8,386	8,386	8,386	8,386	8,386
Bosnia and Herzegovina		11,091	11,091	11,091	11,091	11,091	11,091	11,091	11,091
Bulgaria	11,091	11,091	11,091	11,091	11,091	11,091	11,091	11,091	11,091
Croatia		5,654	5,654	5,654	5,654	5,654	5,654	5,654	5,654
Czech Republic		7,586	7,586	7,586	7,586	7,586	7,586	7,586	7,586
Germany	35,698	35,698	35,698	35,698	35,698	35,698	35,698	35,698	35,698
Hungary	9,303	9,303	9,303	9,303	9,303	9,303	9,303	9,303	9,303
Moldova, Republic of		3,378	3,378	3,378	3,378	3,378	3,378	3,378	3,378
Romania	23,539	23,539	23,539	23,539	23,539	23,539	23,539	23,539	23,539
Slovakia		4,901	4,901	4,901	4,901	4,901	4,901	4,901	4,901
Slovenia		2,852	2,852	2,852	2,852	2,852	2,852	2,852	2,852
Ukraine		60,370	60,370	60,370	60,370	60,370	60,370	60,370	60,370
Yugoslavia, Fed Rep of		10,217	10,217	10,217	10,217	10,217	10,217	10,217	10,217

Land Use
Forests And Woodland (1000Ha)

	1990	1991	1992	1993	1994
Austria	3,227	3,227	3,218	3,241	3,241
Bosnia and Herzegovina			2,100	2,001	2,118
Bulgaria	3,345	3,348	3,348	3,348	3,348
Croatia			2,074	2,074	2,074
Czech Republic			2,629	2,629	2,629
Germany	10,735	10,700	10,700	10,700	10,700
Hungary	1,675	1,701	1,712	1,719	1,719

Metadata



Annex 25

**European Flood Forecasting System
(EFFS), Dr Fröhlich**



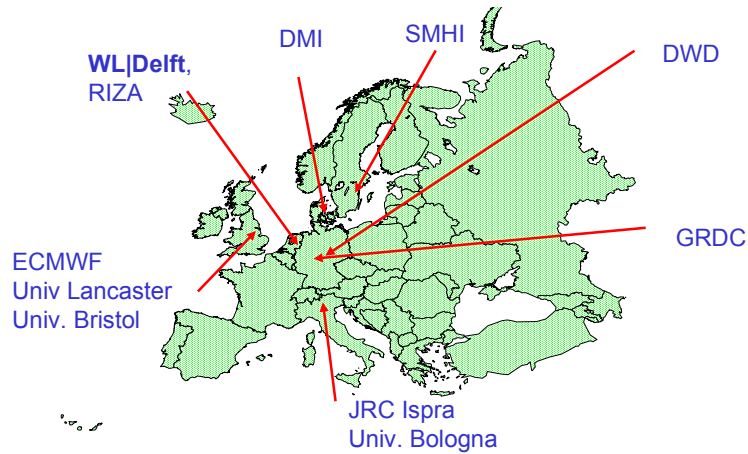
An European Flood Forecasting System - EFFS -



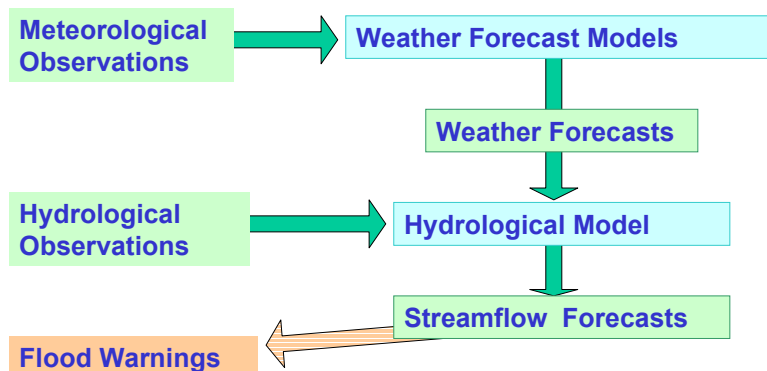
Main Objectives

- Design of a European flood forecasting system with a **4-10 days lead time**
 - Model **small** and **large** river **basins** in Europe
 - Develop and apply a **large scale hydrological model**
 - Develop methods to **include uncertainties** in the operational discharge **forecast**
 - Set-up a **prototype** system
 - Explore methods to disseminate results
 - Finish before March 1, 2003
-

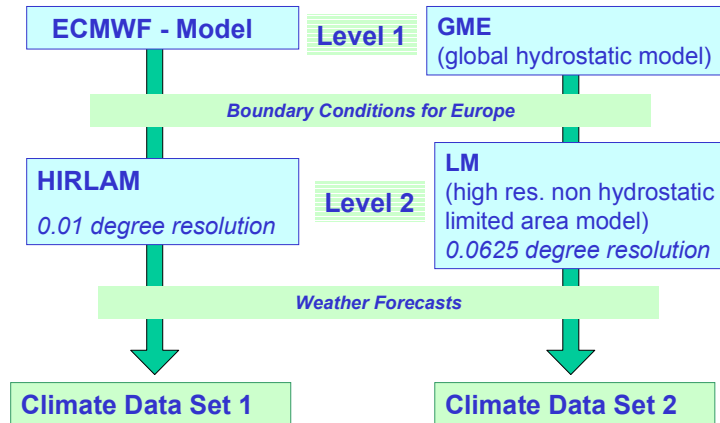
Partners



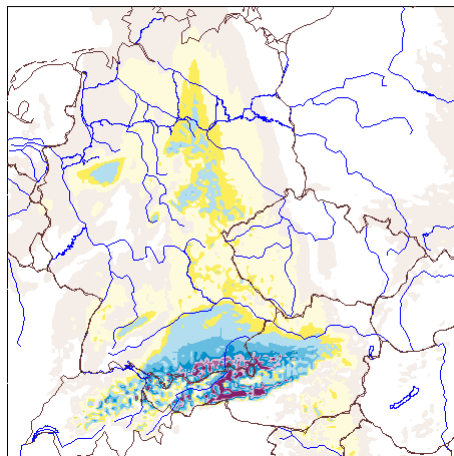
Basic Structure



Weather Forecasts (Re-analyses)



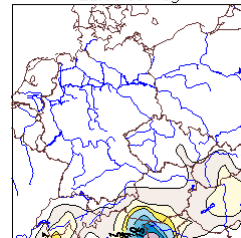
17.03.00-12.00 UTC



0.1 1.0 3.0 6.0 12.0 25.0 50.0 12.8
12-Stunden-Summe (mm)

Example:
Climate Data Set 2
Precipitation

22.03.00-Tag

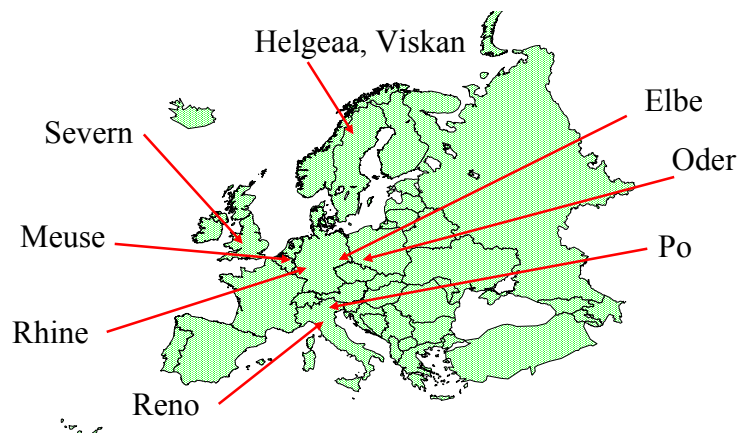


Hydrological Models

- LISFLOOD
- HBV
- TOPKAPI
- TOPMODEL
- 2D-Inundation-Model

- Calibration
- Validation
- Comparison of Results
- Use in operational Mode

Test Basins





Task of GRDC within EFFS

**Deliver of historic river discharge data of certain periods
for calibration and validation of the hydrological models**

**Develop a network for the acquisition and dissemination
of near-real-time discharge data**



Deliver of historic river discharge data

**Check the Status of the GRDC-DB regarding the test
basins and Europe for the test periods**

Detect the responsible Institutions

Contact the services and request and collect the data

Make the data accessible to the project

**New data from 85 Stations (in DT, NL, CH, CR, PL, GB, AT)
could be made available already**

near-real-time discharge data network

Check what is already available

Evaluate the answers to a **WMO-questionnaire** of „WMO-RAVI-Coordination Subgroup on Flood Forecasting and Warning“

Prepare and distribute an **separate questionnaire** together with SMHI (WP10)

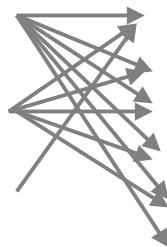
Contact several potential institutions in 27 European countries to get detailed information and to **win them to contribute**

Design an prototype for the automatic collection and storing of near real time discharge data of European rivers

near-real-time discharge data availability

Timely structure

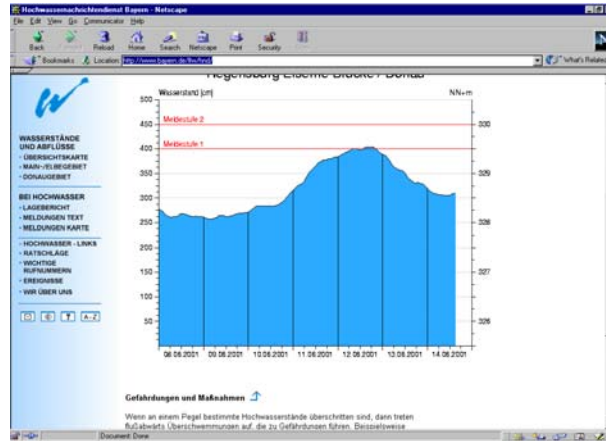
- * Many values per day
(e.g. hourly)
- * One value per day
(at fixed time)
- * Daily statistic
(min., max., mean)
- * No data



Accessibility

- ASCII - Tables
- HTML - Tables
- HTML - Pages
- Tables as picture
- Values in picture
- Hydrograph as picture

Example: Hydrograph (Germany - Thuringia)



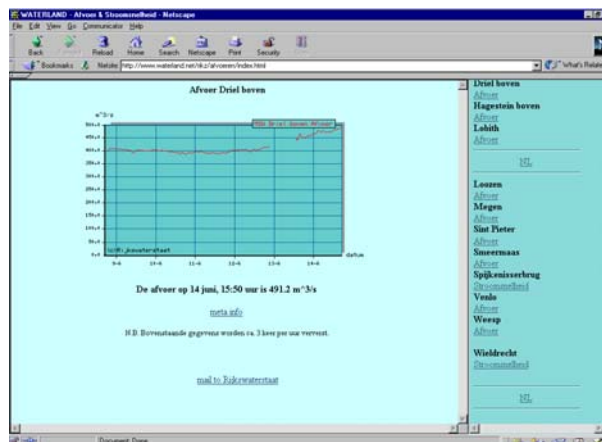
Example: Values in picture (Belgium)

Météo		Hydrologie-Etat des eaux		
		14.06.01		
Voies navigables:		12/06	13/06	14/06
débit en m3/sec				
MEUSE:				
Heer-Agimont fr.	86.7	75.0	81.4	
Ampsin-Neuville	115.2	106.9	99.9	
MEUSE MITOYENNE:				
Lixhe-Aval	84.9	85.9	79.7	
SAMBRE				
Solire-sur-Sambre	4.8	5.5	5.3	
Namur-Salzinnes	16.0	10.9	17.4	
DENDRE:				
Ath	1.9	1.8	2.1	
ESCAUT:				
Tournai	34.7	34.3	39.3	
Source: Service d'Etudes Hydrologiques (M.E.T.-SETHY)				
Page:	520	Sous-page:	1/4	

Example: Table in picture (Lower Austria)

Datum/Uhrzeit (MEZ)	Haidbrunn	Ybbs	Peuerbach	Hornburg	Willingbrunn
14.06.2001 16:00	470	358	435	396	334
14.06.2001 15:00	470	359	440	398	336
14.06.2001 14:00	470	362	442	399	338
14.06.2001 13:00	469	367	442	402	340
14.06.2001 12:00	466	369	443	404	342
14.06.2001 11:00	467	366	443	405	344
14.06.2001 10:00	469	367	444	407	347
14.06.2001 09:00	473	368	447	408	351
14.06.2001 08:00	467	370	449	413	357
14.06.2001 07:00	466	371	450	416	360
14.06.2001 06:00	470	376	449	416	365
14.06.2001 05:00	472	374	451	419	368
14.06.2001 04:00	472	375	456	426	370
14.06.2001 03:00	473	369	465	431	372
14.06.2001 02:00	468	370	471	433	374
14.06.2001 01:00	467	386	474	434	374
14.06.2001 00:00	471	386	479	437	374
13.06.2001 23:00	472	386	484	441	371
13.06.2001 22:00	473	393	487	443	370
13.06.2001 21:00	473	400	487	442	370
13.06.2001 20:00	476	394	492	443	372
13.06.2001 19:00	476	398	491	435	374
13.06.2001 18:00	477	400	487	435	376
13.06.2001 17:00	477	400	487	436	377
13.06.2001 16:00	481	397	488	442	381

Example: Value in HTML - page (The Netherlands)



Example: Table in HTML - Page (Hungary)

A screenshot of a Netscape browser window showing a table of water level data for the Danube (A DUNAI VIZÁLLÁSOK) on June 14, 2001. The table has 7 columns: Állomás (Station), Folyó (River), Jel (Symbol), Vízalás (cm), Napi változás (cm), Viharos m/s, and Vízidő (h). The data rows include stations like Schindling, Fülöp, Mórbarcs, Pétervári, László, Tisza, Kisménfő, Komárom, Pannónia Dévay, Káka, Datarész, Madra, Gyula, Komárom, Esterházy, and Nagymaros.

Állomás	Folyó	Jel	Vízalás (cm)	Napi változás (cm)	Viharos m/s	Vízidő h
Schindling	Ist	○	-	-	-	-
Fülöp	Duna	○	505	-78	763	-
Mórbarcs		○	425	-43	-	-
Pétervári		○	436	-48	-	-
Épürlételek		○	515	-29	-	13.2
László		○	432	-18	-	13.5
Tisza		○	377	-28	-	13.4
Kisménfő		○	456	-46	-	13.3
Komárom		○	416	-34	-	-
Pannónia Dévay		○	443	-60	3740	14.2
Káka		○	81	4	58	16.6
Datarész		○	116	-46	524	14.3
Madra		○	401	-103	3409	14.6
Gyula		○	333	-43	-	14.4
Komárom		○	389	-44	3620	15.1
Esterházy		○	378	-5	-	15.1
Nagymaros		○	321	-29	4000	15.8

Example: Table in ASCII - file (Switzerland)

A screenshot of a Netscape browser window displaying an ASCII table. The table contains 11 columns of numerical data, likely representing time series or forecast data. The data rows start with values like 91, 2, 18, 6, 2001, 264.00, 264.17, 264.31, 19, 6, 2001, 6, 30, -999.00, 264.31.

91	2	18	6	2001	264.00	264.17	264.31	19	6	2001	6	30	-999.00	264.31
91	10	18	6	2001	2137.99	2279.31	2399.24	19	6	2001	6	30	2400.91	264.31
2004	2	18	6	2001	429.77	429.78	429.79	19	6	2001	6	40	-999.00	429.80
2017	2	18	6	2001	413.97	413.98	413.99	19	6	2001	6	40	-999.00	414.00
2022	2	18	6	2001	193.99	194.02	194.06	19	6	2001	6	20	-999.00	193.96
2023	2	18	6	2001	564.47	564.49	564.51	19	6	2001	6	30	-999.00	564.51
2027	2	18	6	2001	372.27	372.29	372.32	19	6	2001	6	20	-999.00	372.32
2031	2	18	6	2001	724.07	724.09	724.11	19	6	2001	6	0	-999.00	724.12
2032	2	18	6	2001	396.91	396.95	396.99	19	6	2001	6	30	-999.00	397.02
2043	2	18	6	2001	396.70	396.72	396.75	19	6	2001	6	40	-999.00	396.78
2093	2	18	6	2001	558.01	558.03	558.04	19	6	2001	6	30	-999.00	558.04
2097	2	18	6	2001	448.83	448.84	448.85	19	6	2001	6	0	-999.00	448.85
2101	2	18	6	2001	270.53	270.55	270.57	19	6	2001	6	30	-999.00	270.51
2118	2	18	6	2001	420.14	420.24	420.43	19	6	2001	6	0	-999.00	420.52
2149	2	18	6	2001	429.75	429.76	429.78	19	6	2001	6	40	-999.00	429.79
2168	2	18	6	2001	504.12	504.12	504.13	19	6	2001	6	10	-999.00	504.12
2207	2	18	6	2001	434.04	434.07	434.11	19	6	2001	6	40	-999.00	434.14
2208	2	18	6	2001	429.74	429.77	429.79	19	6	2001	6	39	-999.00	429.78
2209	2	18	6	2001	406.06	406.08	406.11	19	6	2001	6	30	-999.00	406.13
2618	2	18	6	2001	1790.79	1790.82	1790.85	19	6	2001	6	0	-999.00	1790.78
2618	2	18	6	2001	1790.79	1790.82	1790.85	19	6	2001	6	0	-999.00	1790.78
2009	2	18	6	2001	375.71	376.14	376.40	19	6	2001	6	20	-999.00	375.80
2009	10	18	6	2001	286.74	381.56	445.11	19	6	2001	6	20	305.31	-999.00
2011	2	18	6	2001	484.40	484.73	485.05	19	6	2001	6	10	-999.00	484.40
2011	10	18	6	2001	151.86	201.92	250.90	19	6	2001	6	10	152.43	-999.00



near-real-time discharge data availability

Country	Q	W	time step	Reported Time	Values	Graph
Italy	-	47	<1h	NRT	-	-
Belgium	15	-	24h	06:00	graphic Table: mean(d)	Graph
The Netherlands	11	90	<1h	NRT	html-Page (latest value)	Graph
Swiss	107	129	24h	08:45	ASCII-Table: value at ~8:00; min, mean, max (last day)	-
	*	*	<1h	NRT	-	Graph
Poland	-	74	24h	06:00	html-Table	-
Czech	32	32	24h	07:00	html-Table	-
Slovakia	-	11	24h	06:00	html-Table	-
Hungary	63	105	24h	07:00	html-Table	-
Slovenia	16	17	<1h	NRT	html-Table (latest value)	-
	24	20	24h	08:00	html-Table	-
Yugoslavia	-	40	24h	10:00	html-Table	-
Island	28	28	<1h	NRT	graphic Table (latest values, min, mean, max)	Graph
Germany						
WSV	-	92	6h	05:00	html-Table	-
	*	*	<1h	NRT	-	Graph
BY	70	70	24h	06:00	html-Table	-
	*	*	<1h	NRT	-	Graph
TH	50	50	24h	05:00	html-Table	-
RP	-	54	24h	06:00	html-Table	-
BW	-	13	1h	NRT	html-Table	-
Austria						
OÖ	-	11	24h	07:00	html-Table	-
NÖ	-	22	1h	NRT	graphic Table	-
VB	-	4	1h	NRT	graphic Table	-
KA	-	20	<1h	NRT	-	Graph
TI	-	37	<1h	NRT	-	Graph



Example for NRT - data delivery to GRDC

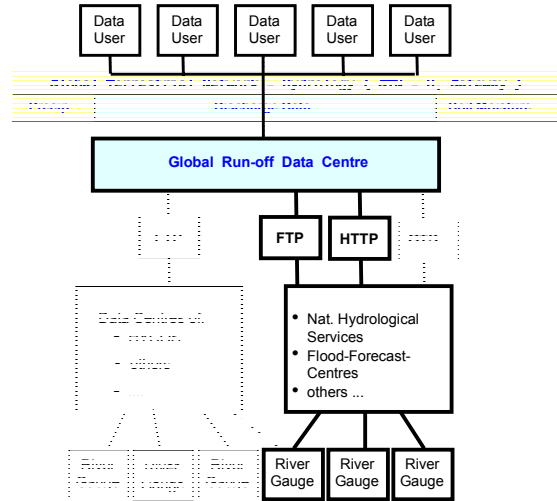
```
#Country code : XX
#Sender Code : XXXX
#File created on: 2001.06.01 04:48:08 (MEST = UTC +2h)
#Disclaimer: Data in this file are provisional and
#subject to revision.
#Number of following data blocks: 2
#Date and Time (mm.dd hh:mm MEST = UTC +2);
#Number of parameters: 2
# 1 Streamflow (m3/s);
# 2 Water Level (cm);
Station Number: 111111111
Station Name : xxxxx
River Name : xxxxx
05.25 06:00; -999.00; 312;
05.25 06:15; 4.19; -999;
05.25 06:30; 4.07; -999;
Station Number: 222222222
Station Name : yyyyy
River Name : yyyyy
05.25 05:23; 4.32; 548;
05.25 05:28; -999.00; 587;
05.25 05:45; 2.68; 568;
05.25 06:17; 2.63; -999;
05.25 07:08; 111.34; 692;
05.25 07:21; 673.85; 748;
end
```

Consider already used formats

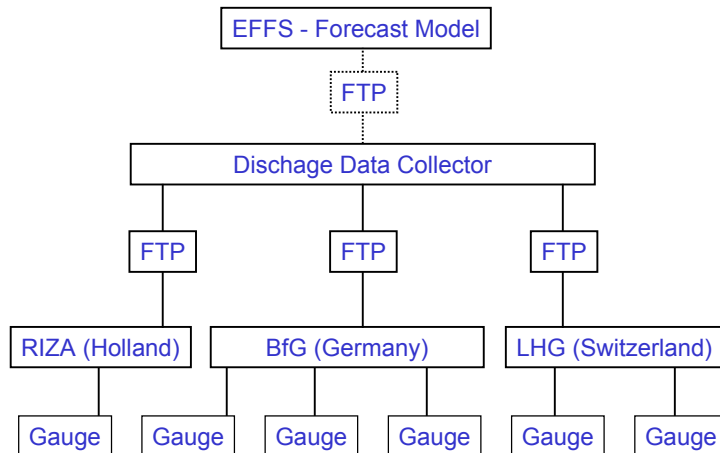
Keep the format as clear and simple as possible

Minimize the expense for the providers

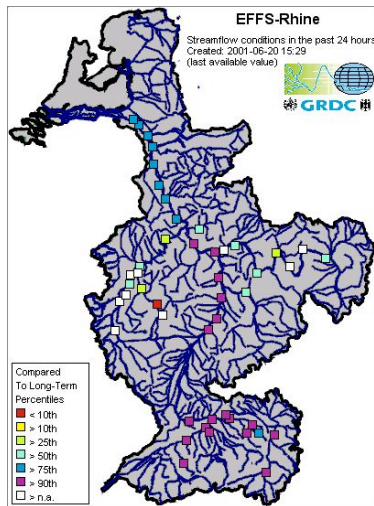
Discharge Data Collector for EFFS



Discharge Data Collector for EFFS (test: Rhine basin)



Discharge Data Collector for EFFS (test: Rhine basin)



Every hour:

Preparing Outputfile for FTP

Preparing Picture

Analyzing

Storing (Data Base)

Timely normalizing

Collecting data (FTP)

Conclusion

main tasks to fulfill :

* Win the NHSS

- to participate

- to serve the standards

← problem

* Develop the Software

* Keep the system running

Annex 26

Status and Activities of GRDC

cooperations within the UN-Programmes

GEWEX, GHP, CEOP, ISLSCP,

Dr Fröhlich



Status and Activities of GRDC co-operations within the UN - Programmes

GEWEX

- GHP

- CEOP

- ISLSCP



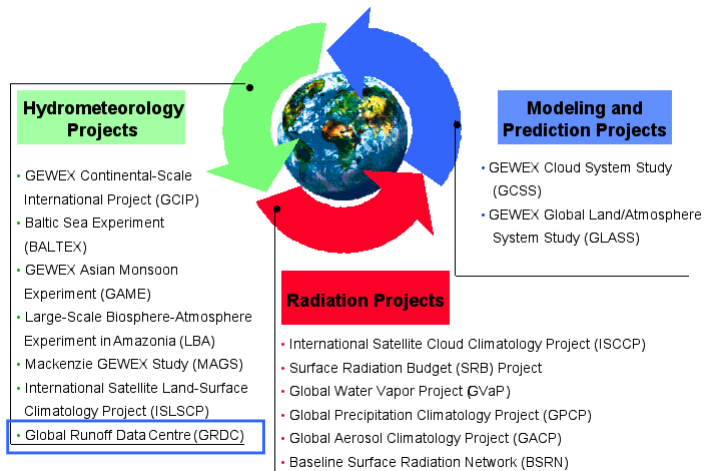


GEWEX

WCRP

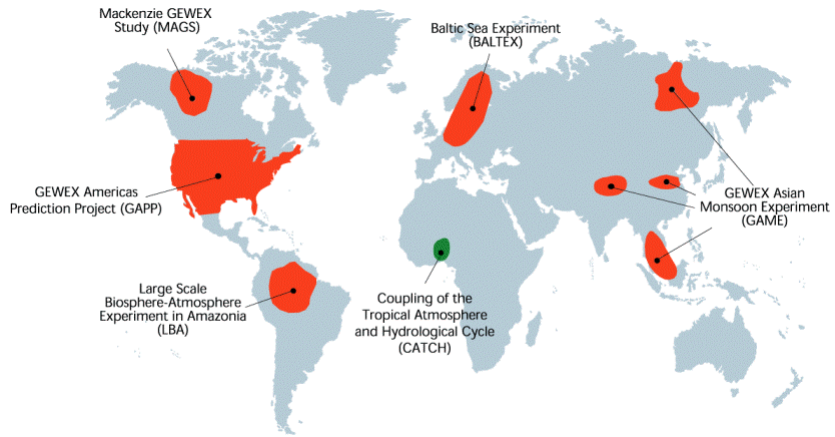


GEWEX Global Energy and Water Cycle Experiment





Continental Scale Experiments



GEWEX Hydrological Panel (GHP)

Is coordinating the work of Continental Scale Experiments (CSE's) and related GEWEX-projects, activities, data centres ...



Coordinated
Enhanced
Observing
Period

CSE's:





International Satellite Land Surface Climatology Project (ISLSCP)

1983, 1984 - first meetings - idea of combination of large-scale field experiments and a stream of satellite data products

1987- Workshop reviewed the status of the algorithms

1992 - Workshop The **ISLSCP-I data collection** was borne out (four key areas: land cover, hydrometeorology, radiation, and soil)

CD set - cover four areas, span the **1987-1988**, spatial resolution ($1^\circ \times 1^\circ$) temporal resolution **monthly** (a few are finer (e.g., 6 -hourly))



ISLSCP - II

1999 - NASA's Hydrology program provided funding to initiate the production and publication of the ISLSCP Initiative II data collection

Phase II will be finished in **May 2002**

10-year period from **1986 to 1995** - spatial resolution: 1° for the meta data and 0.5° and 0.25° for topography, soils, and vegetation parameters



ISLS SCP - II - Data Sets Overview

Data Category	Data Set	Parameter (only from Category: Hydr/Topo/Soil)	
Near Surface Meteorology (ECMWF, NCEP)	Re-Analysis Fixed Fields	Disaggregated Total Precipitation (GPCP/DX)	
	Re-Analysis Monthly Fields	Precipitation (Gauge Only)	
	Re-Analysis 3-Hourly Fields (A+F)	Precipitation (Satellite & Gauge)	
	Re-Analysis 3-Hourly Fields (F)	Precipitation (Pentad Dataset)	
	Re-Analysis Monthly 3-Hourly Fields (A+F)		
	Re-Analysis Monthly 3-Hourly Fields (F)	Monthly Gauge Streamflow Data	
		Spatially Distributed Runoff	
Radiation and Clouds (SRB, ISCCP)	Radiation 3-Hourly Fields	Mean Elevation	Drainage density
	Radiation Fixed Fields	Variance of Elevation	River Transit
	Radiation Monthly 3-Hourly Fields	Mean Silhouette	Speed/Rating Grade
Carbon	Radiation Monthly Fields	Maximum Elevation	Flow Directions
	Carbon Gridded Data	Minimum Elevation	Basin ID Grid
	Carbon Point Data	Median Elevation	Topological Basin Table with Attributes
	Sea Surface Temperature	Mean Local Slope	Upstream Catchment Area
Hydrology, Topography, and Soils		Mean Local Aspect	Distance to Basin Outlet
	Precipitation	Topographic Index	Cell ID Grid
	Rivers	Large-Scale Aspect	Cell Area
	Topography	Large-Scale Slope	Topological Cell Table with Attributes
	Soils	Elevation Distribution	
Snow and Sea Ice	Sea Ice	PDF Shape Parameter (elevation distribution)	
	Snow	Basin Boundaries (Hydro1k, generalized to match STN-30)	
Vegetation	Biophysics	Soil Texture	
	EOS Land Validation Core Site Data	Sand, Silt, Clay, Organic Contents	
	Land Cover	Bulk Density	
	Roots	Retention Curve Information	
Others		Soil Heat Capacity	
	Land/Water Mask	Soil Thermal Conductivity	
	Population	Pedon Characteristics (type, C, N, parent material, etc.)	

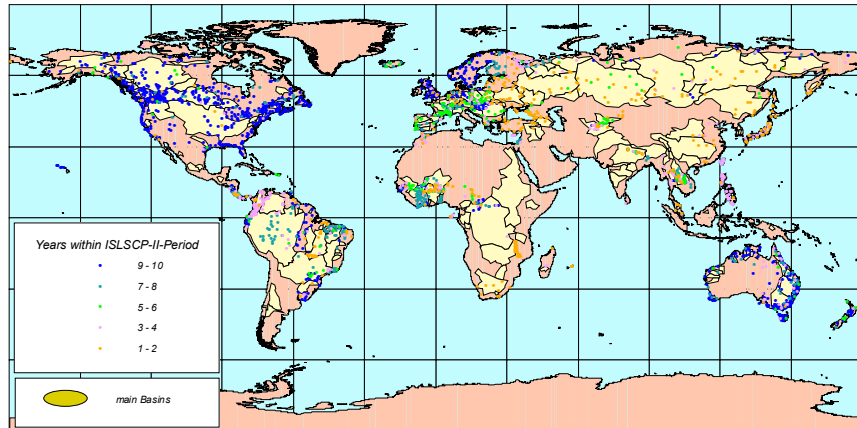


ISLS SCP - II - Runoff Data Sets

ISLS SCP Initiative II Parameter List 1986-1995									
all Runoff / Streamflow Data Sets									
No.	Data Category	Data Set	Parameters	Originating Institution/Project/Author	Temporal Resolution	Temporal Extent	Original Spatial Resolution	Spatial Resolution	Spatial Extent
82	Near Surface Meteorology	ECMWF Re-Analysis Monthly 3-Hourly Fields (Forecasts)	Runoff (Mean, Stdev.)	ECMWF (ERA-40)	Monthly 3hrly	1986-1995	1 deg.	1 deg.	Global
100	Near Surface Meteorology	ECMWF Re-Analysis 3-Hourly Fields (Forecasts)	Runoff	ECMWF (ERA-40)	3hrly	1986-1995	1 deg.	1 deg.	Global
130	Near Surface Meteorology	NCEP Re-Analysis Monthly 3-Hourly fields	Runoff	NCEP	Monthly 3hrly	1986-1995	~2 deg.	1 deg.	Global
216	Hydrology, Soils and Topography	Rivers	Monthly Gauge Streamflow Data	GRDC	Monthly, with gaps	1986-1995	Point Data	Point Data	Stations scattered Globally
217	Hydrology, Soils and Topography	Rivers	Spatially Distributed Runoff	UNH/GRDC	Monthly	1986-1995	0.5 deg	0.5 deg	Global



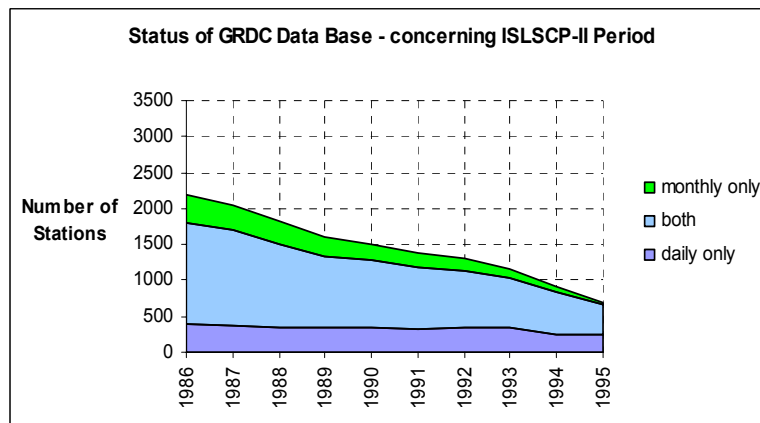
ISLSCP - II - GRDC Data Sets



GRDC, February 2001



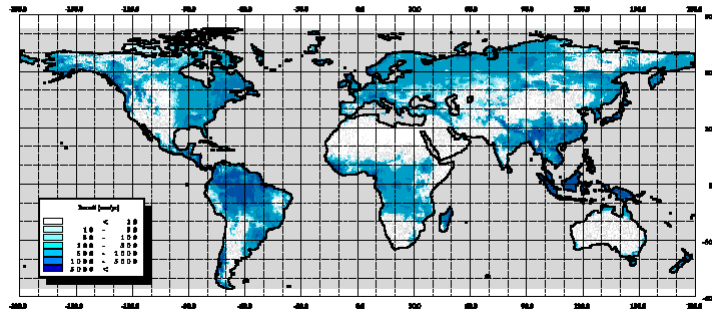
ISLSCP - II - GRDC Data Sets





ISLSCP - II - GRDC Data Sets

Composite Mean Annual Runoff 30-minute spatial resolution

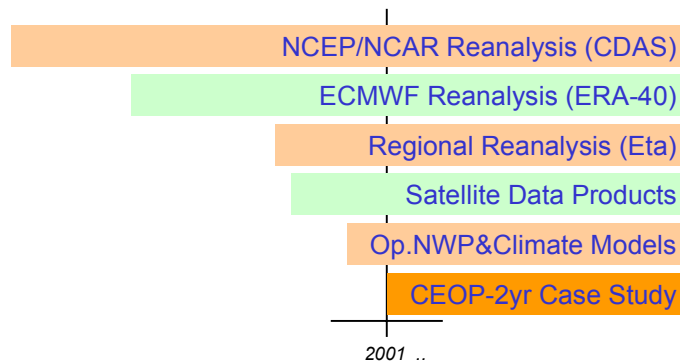


From GRDC-Report 22 (GRDC / University of New Hampshire)

CEOP - Coordinated Enhanced Observing Period

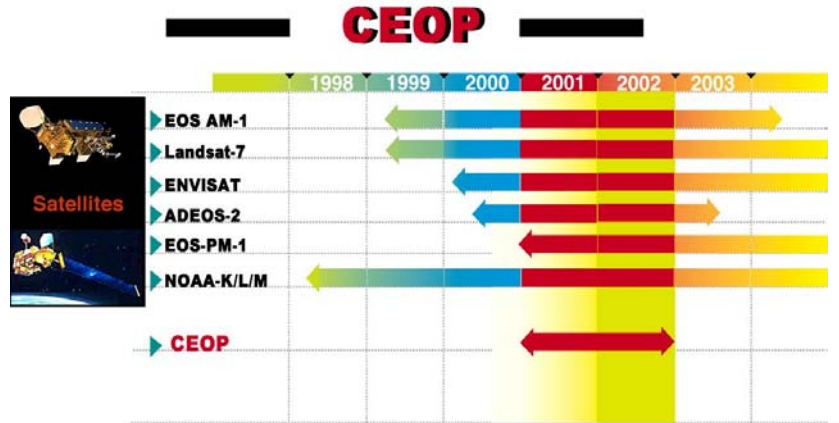
Motivation:

Guide to the interpretation of the longer term variability depicted in historical records and the reanalysis results



CEOP - Coordinated Enhanced Observing Period

Earth Observing Satellite Missions:



CEOP - Coordinated Enhanced Observing Period

Short history

- 1995 1. GHP (in Visby, Sweden) - idea was born
- 1997 3. GHP (in Sapporo, Japan) - it was proposed that there be **a selected time period for simultaneous investigations** of the WEC - upon and extend the individual components of GHP; **setup a working group** to investigate the feasibility considering that:
- * the **readiness** of a critical number of **researchers**
 - * the **maturity** of a number of **global models**
 - * a **new generation of EOS** will be launched soon

Result: CEOP 2001 - 2003



CEOP - Coordinated Enhanced Observing Period

Main Objectives:

Demonstrate added skill in predictions up to seasonal for water resource applications using improved land-hydrology models

Conduct a coordinated regional experiment in one or more of the significant heat source and sink regions, such as the Asian-Australian monsoon, the American monsoon and the African monsoon, that drive and modify the climate system and anomalies.



CEOP - Coordinated Enhanced Observing Period

Summary:

Given the state of the global circulation and its oceans and cryosphere for a particular 2-year period,
what are the water-energy-circulations over various land areas for this period,
how are they functioning,
can we model these adequately for our needs, and
what are the implications for predictability?

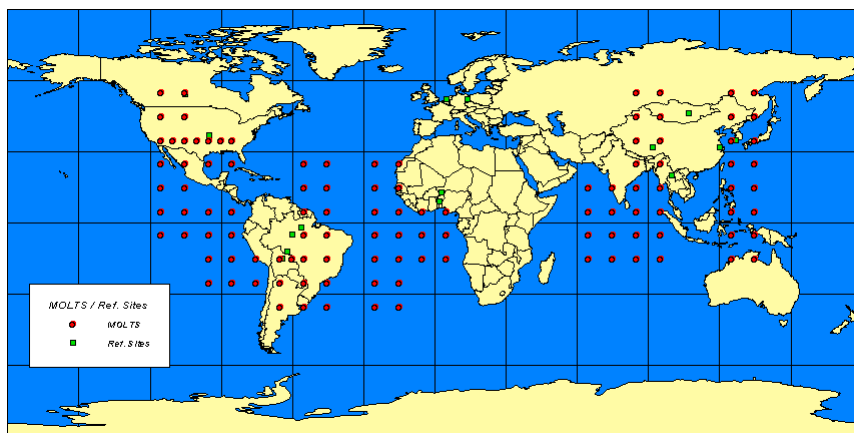
The key to success of CEOP is to utilize model output and remote sensing data to the extent possible with the reference sites used as "validation" or ground truth.

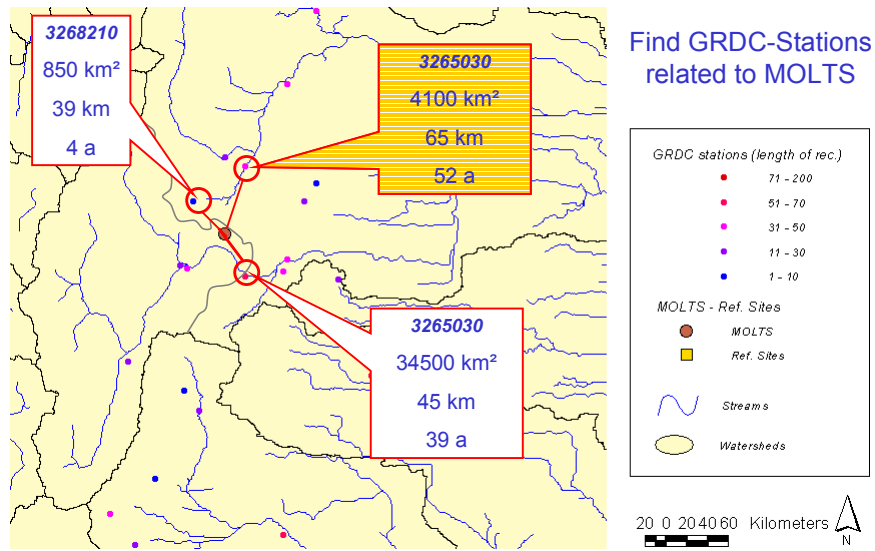
CEOP - Coordinated Enhanced Observing Period

Time Frame:

EOP	Begin	End	(1) WWW	(2) CD	(3) Reanalysis			
EOP 1	01.07.2001	30.09.2002	30.09.2002	01.01.2003	31.01.2003			
EOP 2	01.10.2001	30.09.2002				complete	CD	
EOP 3			01.10.2002			End	complete	CD
						30.09.2003	30.09.2004	30.06.2005

CEOP - Coordinated Enhanced Observing Period





5. GHP - Business Session (Geesthacht, 15 - 17 Sept. 1999)

"Progress within ISLSCP and GRDC was also recognized."

6. GHP - Business Session (Angra dos Reis, 12 - 15 Sept. 2000)

"Progress within ISLSCP and GRDC has also been substantial with the major progress towards a ISLSCP II dataset being a prime example."

Annex 27

**International Hydrological Programme
(IHP), Mr. Jimbow, UNESCO**



UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND
CULTURAL ORGANIZATION

International Hydrological Programme (IHP)



<http://www.unesco.org/water/ihp/index.shtml>

1965-1974 IHD **Experimental** Basins

Catalogue of Very Large Floods

Fresh Water Balance

1975-1980 IHP-I

1981-1983 IHP-II

1984-1989 IHP-III Hydrology and the Scientific Bases for
Rational Water Resources Management

1990-1995 IHP-IV Hydrology and Water Resources for
**Sustainable Development in a Changing
Environment**

1996-2001 IHP-V Hydrology and Water Resources under
Vulnerable Environment

2002-2007 IHP-VI Water **Interactions:**
System at Risk and **Social Challenges**





**HYDROLOGY AND WATER
RESOURCES DEVELOPMENT
UNDER VULNERABLE
ENVIRONMENT**

Detailed Plan of the Fifth Phase (1996-2001) of the IHP



IHP-V

Theme 1: Global hydrological and geochemical processes

Theme 2: Ecohydrological processes in the surficial environment

Theme 3: Groundwater resources at risk

Theme 4: Strategies for water resources management in emergency and conflicting situations

Theme 5: Integrated water resources management in arid and semi-arid zones

Theme 6: Humid tropics hydrology and water management

Theme 7: Integrated urban water management

Theme 8: Transfer of knowledge, information and technology



WATER INTERACTIONS: SYSTEMS AT RISK AND SOCIAL CHALLENGES

Draft Plan for the
International Hydrological Programme
of UNESCO Phase VI
(2002-2007)



Themes of the Sixth Phase of IHP

- 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**



Theme 1 **Global Changes and Water Resources**

Focal Area 1.1: Global estimation of resources: water supply and water quality (*) ()**

Focal Area 1.2: Global estimation of water withdrawals and consumption ()**

Focal Area 1.3: Integrated assessment of water resources in the context of global land-based activities and climate change (*)()**

(*) Indicates connections with FRIEND

(**) Indicates connections with HELP



Theme 2 **Integrated Watershed and Aquifer Dynamics**

Focal Area 2.1: Extreme events in land and water resources management (*)

Focal Area 2.2: International River Basins and Aquifers (*)

Focal Area 2.3: Endorheic Basins (*)

Focal Area 2.4: Methodologies for integrated river basin management (*)()**

(*) Indicates connections with FRIEND

(**) Indicates connections with HELP



Theme 3 Land Habitat Hydrology

Focal Area 3.1: Drylands (*)()**

Focal Area 3.2: Wetlands (*)

Focal Area 3.3: Mountains (*)()**

**Focal Area 3.4: Small islands and coastal
zones (*)**

**Focal Area 3.5: Urban areas and rural
settlements (*)**

(*) Indicates connections with FRIEND

(**) Indicates connections with HELP



Theme 4 Water and Society

Focal Area 4.1: Water, civilization and ethics

Focal Area 4.2: Value of water

**Focal Area 4.3: Water conflicts - prevention and
resolution (**)**

**Focal Area 4.4: Human security in water-related
disasters and degrading
environments (*)(**)**

**Focal Area 4.5: Public awareness raising on water
interactions (*)(**)**

(*) Indicates connections with FRIEND

(**) Indicates connections with HELP



Theme 5 Water Education and Training

Focal Area 5.1: Teaching techniques and material development (*)()**

Focal Area 5.2: Continuing education and training for selected target groups (*)

Focal Area 5.3: Crossing the digital divide (*)

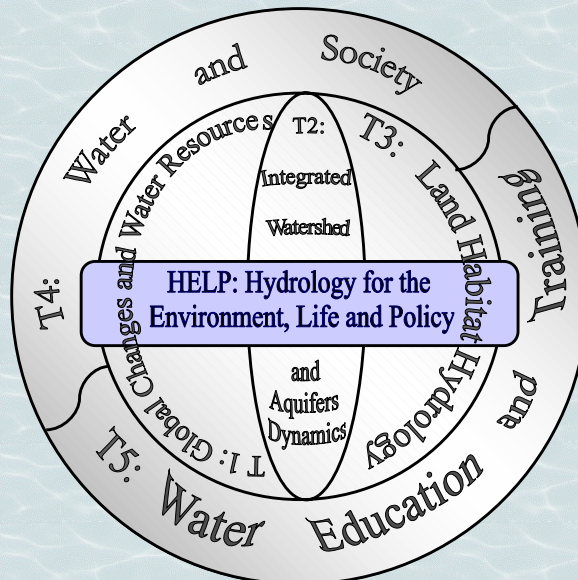
Focal Area 5.4: Institutional development and networking for WET (*)

(*) Indicates connections with FRIEND

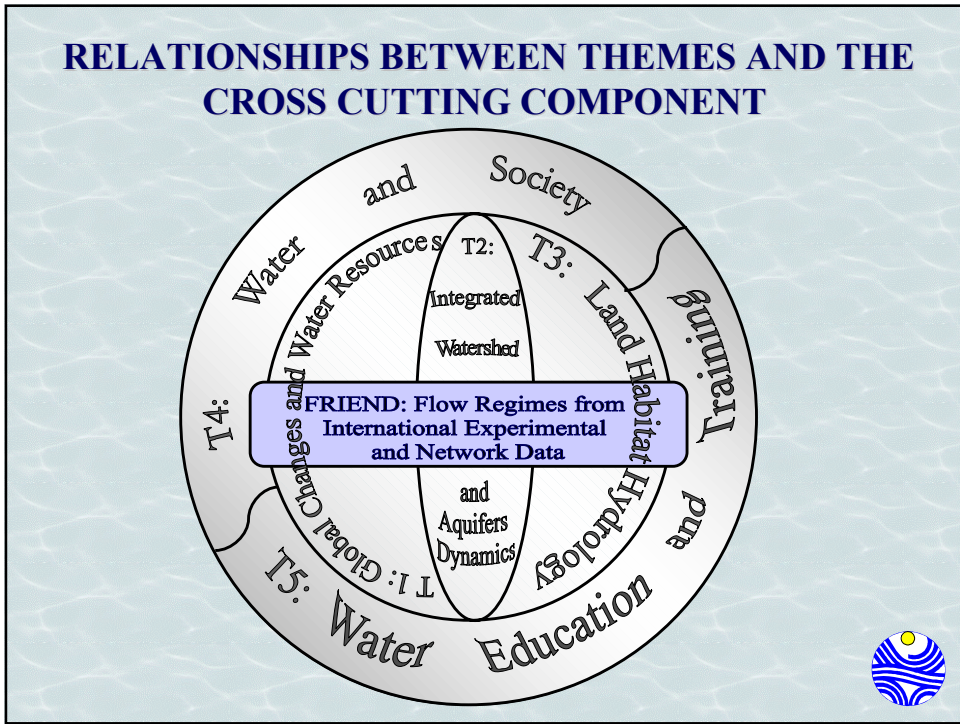
(**) Indicates connections with HELP



**HELP AS CROSS CUTTING PROGRAMME
COMPONENT OF IHP VI**



RELATIONSHIPS BETWEEN THEMES AND THE CROSS CUTTING COMPONENT



Annex 28

**World Water Assessment Programme
(WWAP), Mr. Jimbow, UNESCO**

World Water Assessment Programme (WWAP)

The State of The World's Freshwater Resources

<http://www.unesco.org/water/wwap/index.shtml>

Background

- 1977 UN Conference on Water – Mar del Plata
- 1992 Dublin, Rio
- 1997 1st World Water Forum, Marrakech
- 1999 World Conference on Science World Water Vision
- 2000 2nd World Water Forum, The Hague

Outcomes are:

- **2001 International Conference on Freshwater (Dublin + 10), in Bonn, December**
- **2002 World Summit on Sustainable Development (Rio + 10), in Johannesburg, September**
- **2003 3rd World Water Forum, in Kyoto, March**

Government's Appeal to UN

- **Provide information on state of the world's water resources in the areas agreed during the ministerial meeting at The Hague**

Major Challenges

- **Meeting Basic Needs (Human Health)**
- **Securing the food supply (Agriculture, Livestock and Aquaculture)**
- **Protecting ecosystems (Ecosystem Health)**
- **Sharing water resources (Including Intersectoral allocation, Transboundary Issues and Conflicts)**
- **Managing water related risks (Including Extreme Events)**
- **Valuing water (Economic Value, Cost recovery)**
- **Governing water wisely (At All Levels)**

Targets

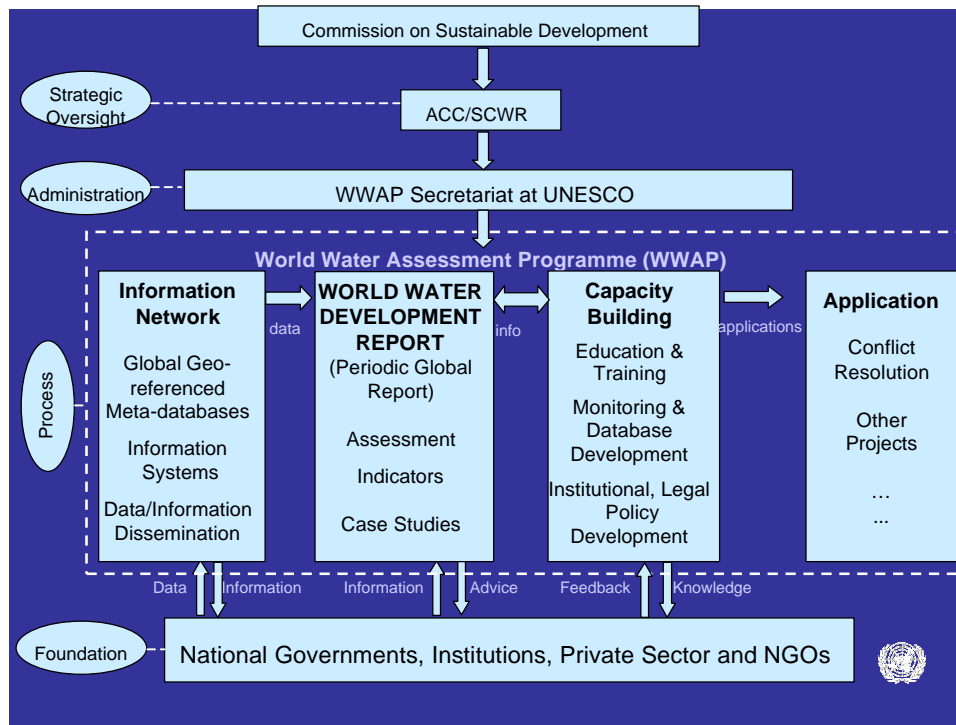
- **Meeting Basic Needs (Human Health)**
 - - Proportion of people without access to hygienic sanitation facilities to be halved by 2015
 - - Proportion of people not having sustainable access to adequate quantities and safe and affordable water to be halved by 2015
- **Securing the food supply (Agriculture, Livestock and Aquaculture)**
 - - Increase water productivity for food production from rainfed and irrigated farming by 30% by 2015
- **Protecting ecosystems (Ecosystem Health)**
 - - National standards to ensure the health of ecosystem in all countries by 2005
- **Sharing water resources**
 - - Reducing competition over transboundary rivers and aquifers
- **Managing water related risks (Including Extreme Events)**
 - -Reduce the proportion of the population threatened by water-related hazards by 50% by 2015
- **Valuing water (Economic Value, Cost recovery)**
 - - Economic value of water be recognized and fully reflected in national policies and strategies by 2005
 - - Mechanisms be established to facilitate full cost pricing for water services whilst ensuring needs of the poor are guaranteed by 2015
- **Governing water wisely (At All Levels)**
 - - Comprehensive policies and strategies for IWRM in process of implementation in 75% of countries by 2005 and in all countries by 2015

Other Considerations are:

- **Ensuring the knowledge base**
- **Water for Energy**
- **Water for Industry**

WWAP's Key Contributions

- **Report on the UN system-wide initiative to follow up on the major challenges**
- **Establish an ongoing monitoring system**
- **Indicators on water related stress**
- **Case Studies**
- **Capacity building framework**



Major Thinking Behind WWDR

- Framework of Sustainable Development
- Global Security and Poverty Alleviation
- Integrated Water Resources Management (IWRM)
- Recognizes River Basins or Aquifers as appropriate natural units for IWRM
- Regional and Local Perspectives, as well as Global Overviews
- World leaders' call to the UN agencies to report on the state of the water resources

Aims of WWDR

- To identify and describe the nature and magnitude of water crises
- To assess the resilience of societies in their ability to cope with the stresses
- To assess the effectiveness of policies adopted by societies to overcome stress
- To provide advice on the most effective ways of building capacity to address stress.
- To develop indicators of water related stress

WWDR Target Audience

Biennial Reports to Commission on Sustainable Development:

- **Decision-makers at all levels**
- User Associations
- Institutions
- Private Sector
- General Public

WWDR Contents

- **Volume 1 : The State of the World's Freshwater Resources and their Use**
 - **Policies**
 - **Global overviews**
- **Volume 2 : Indicators**
- **Volume 3 : Case Studies**

Questions to be applied to each policy issue

- **Why was the policy advocated ?**
- **Where and by whom it was advocated?**
- **To what extent and at which levels of government was it adopted?**
- **Were there obstacles to the process of adoption and, consequently, at what rate has adoption progressed?**
- **Has the adoption of policy led to a change in water management?**
- **Has the change in management led to a change in the availability or effective use of the resource base?**
- **Have resultant changes improved the condition of the people?**
- **Have the resultant changes improved or worsened the status of the natural environment?**

Development of Indicators

- **Collection of Data, Information and Knowledge**
- **Processing, Analysis and Synthesis**
- **Development of Appropriate Indicators**
- **Monitoring and Evaluation of Indicators at Appropriate Scale**

Proposed Case Studies

Region	Country	River	Scale	Remarks
Asia	Japan	Tokyo	Small	Mega City
		Yellow	Large	
		Mekong	Large	International
	Nepal			
	Sri Lanka			
		Aral Sea Basin	Large	
		Godavari	Large	
	Thailand	Chao Phraya/ Bangkok	Medium	Mega City
South America	Jamaica			
		Parana	Large	International
	Bolivia			
Australia		Murray-Darling	Large	
Europe		Danube	Large	International
	France	Seine-Normandie	Medium	
		Volga	Medium	
	Baltic Sea			
Africa	Ghana			
	Kenya			
		Nile	Large	International
		Limpopo/Botswana	Large	International
	South Africa			
North America	USA	San Francisco Bay Area	Medium	

Expert Advisory Group

Evaluate plans/proposals and recommend to WWAP:

- Protocols/Template for Case Studies,
- Applications/Components of system,
- In depth feasibility study,
- Overall development plan, etc.

Annex 29

**GEMS/Water Programme, Mr. Fraser,
Environment Canada**



**UNEP GEMS Collaborating Centre for Freshwater Quality
Monitoring and Assessment**

GEMS/WATER PROGRAMME



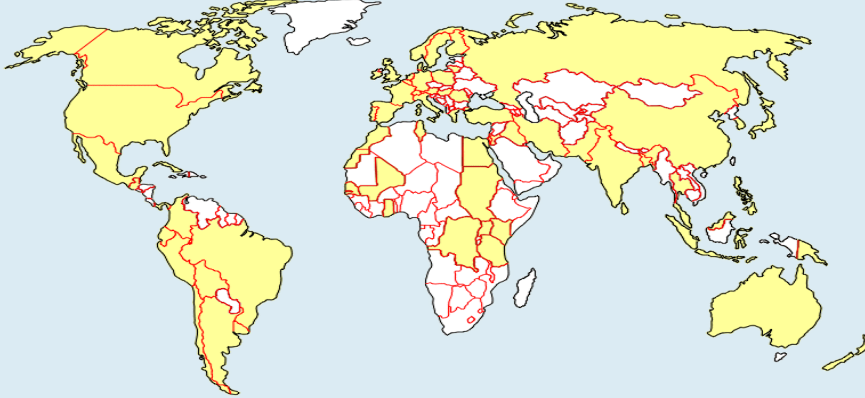
GEMS/WATER

National Water Research Institute (NWRI)
at the
Canada Centre for Inland Waters
Burlington, Ontario

GEMS / WATER Collaborating Centre

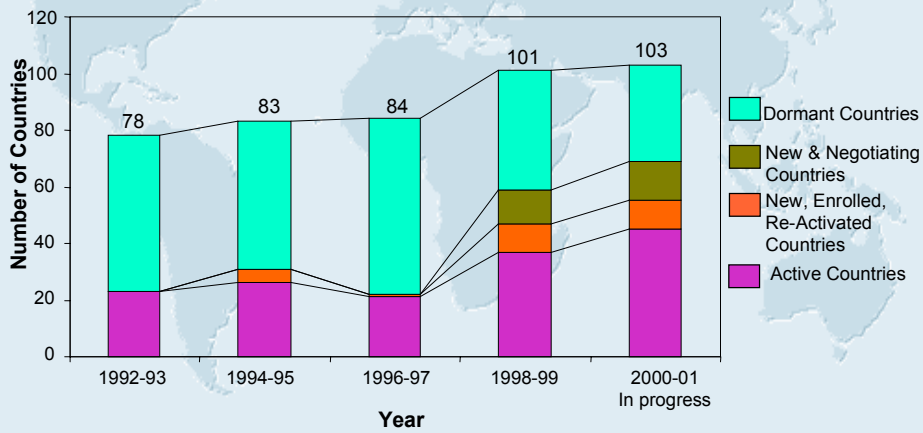
- Operates Global Data Bank.
- Undertakes analysis, assessment and interpretation activities.
- Capacity building activities through country missions and QA/QC programme.
- Partnerships and publications.

Participating Countries



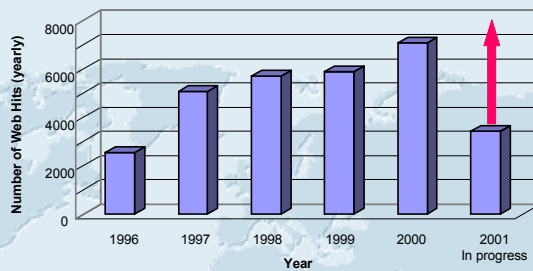
	AFRA	AMRA	EMRA	EURA	SEAA	WPRA	TOTAL
Number of Data points	12275	182114	60280	674396	314604	373974	1617643

GEMS/Water Countries (Bi-Annual)



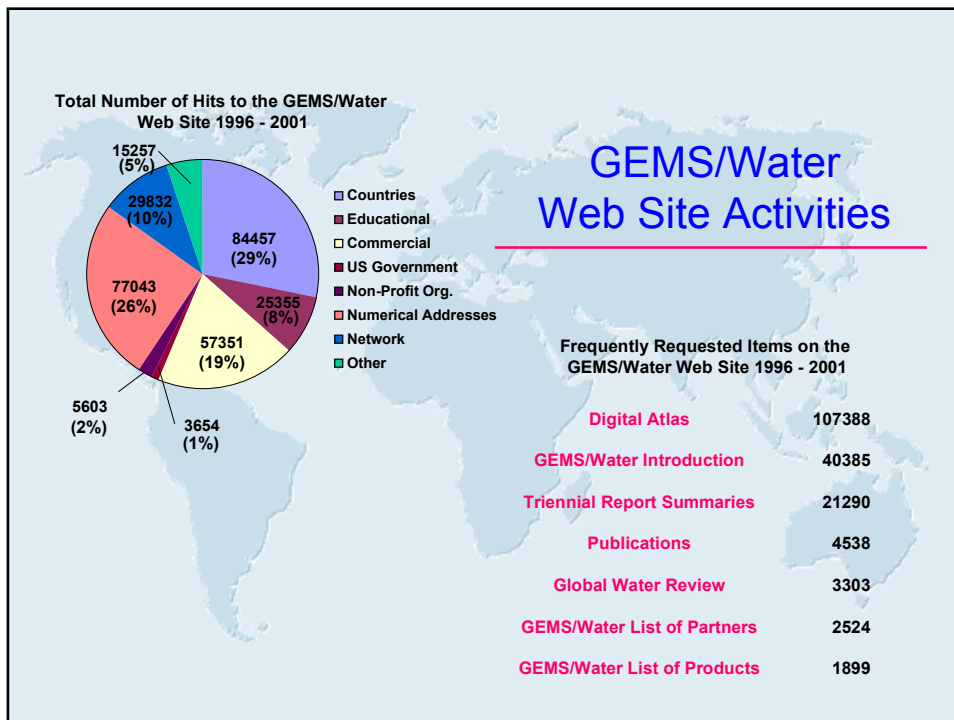
Year 2000-01 Country Data Activities

Argentina	Germany	Korea	Portugal
Austria	Hong Kong	Lithuania	Russia
Belgium	Hungary	Grand Duchy of Luxembourg	Senegal
Canada	India	Maroc	Spain
Denmark	Ireland	Netherlands	Sweden
Finland	Italy	New Zealand	Thailand
France	Japan	Pakistan	United Kingdom
Greece	Jordan	Philippines	



GEMS/Water Web Site Activities

Andorra	Costa Rica	Guyana	Luxembourg	Qatar	United Arab Emirates
Argentina	Czech Republic	Hong Kong	Macau	Romania	United Kingdom
Armenia	Croatia	Hungary	Malaysia	Russia	United States
Australia	Cyprus	Iceland	Malta	Senegal	Uruguay
Austria	Denmark	India	Mauritius	Singapore	Vatican City State
Bahrain	Dominican Republic	Indonesia	Mexico	Slovak Republic	Venezuela
Belarus	Ecuador	Ireland	Moldavia	Slovenia	Yugoslavia
Belgium	Egypt	Israel	Morocco	South Africa	
Bolivia	El Salvador	Italy	Netherlands	South Korea	
Botswana	Estonia	Ivory Coast	New Caledonia	Soviet Union	
Brazil	Ethiopia	Jamaica	New Zealand	Spain	
Brunei Darussalam	Faroe Islands	Japan	Nicaragua	Sri Lanka	
Bulgaria	Fiji	Jordan	Norway	Sweden	
Burkina Faso	Finland	Kenya	Pakistan	Switzerland	
Cambodia	France	Kirgistan	Panama	Taiwan	
Canada	Germany	Kuwait	Philippines	Thailand	
Chile	Greece	Latvia	Poland	Trinidad & Tobago	
China	Guam	Lebanon	Portugal	Turkey	
Colombia	Guatemala	Lithuania		Uganda	



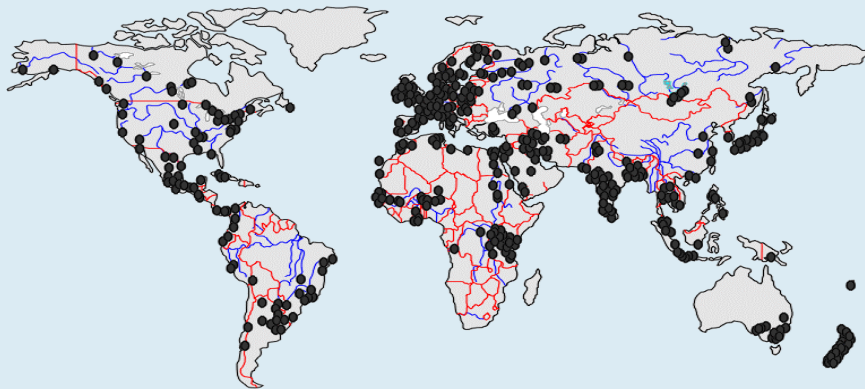
Database Access and Data Distribution

- Web access to data products
- Map based selection criteria
- Interactive query and analysis
- Graph and table generation
- Digital download capability

Station Configuration

- Rivers
- Lakes & Reservoirs
- Groundwater
- Baseline
- Impact
- Trend
- Flux

GEMS/Water Stations



Global Regions

PARAMETER CLASSIFICATION

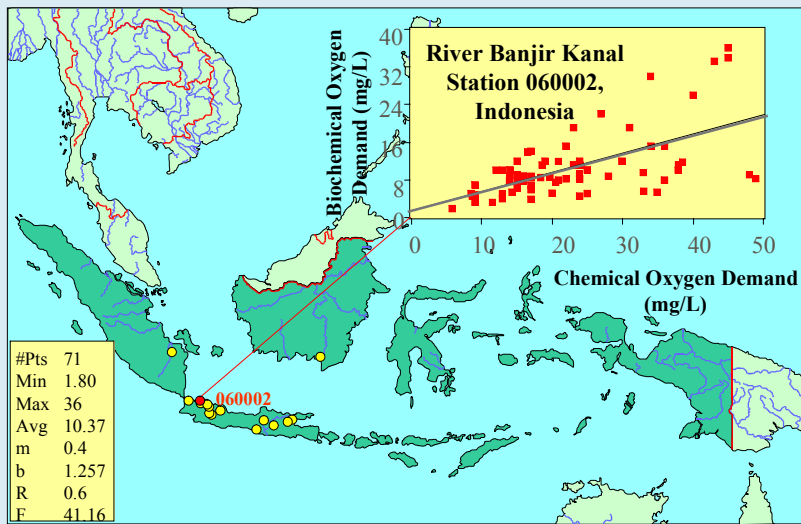
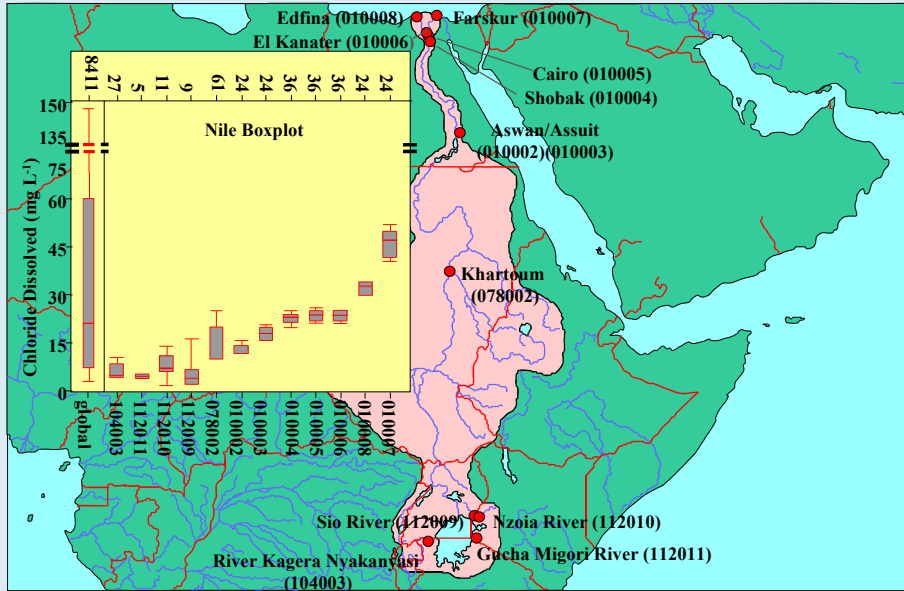
Station	Phys/Chem	Major Ions	Metals	Nutrients	Organic Contaminants	Micro-Biology	Date Range
AFRA	2021	3916	967	1914	4	339	1978-1998
AMRA	33168	35226	31249	27157	3545	9384	1978-1999
EMRA	12257	14897	10054	8413	366	2963	1978-2000
EURA	112814	119061	126778	98685	11944	18968	1978-2000
SEAA	73186	96100	20088	53626	267	13859	1978-1999
WPRA	57314	39880	46627	68879	6537	9553	1978-2000
Total	290760	309080	235763	258674	22663	55066	1978-2000

Note: Information includes surface and groundwater combined.
Reported numbers represent number of data points in the GEMS/Water Archive.

Receiving Data From Participating Countries

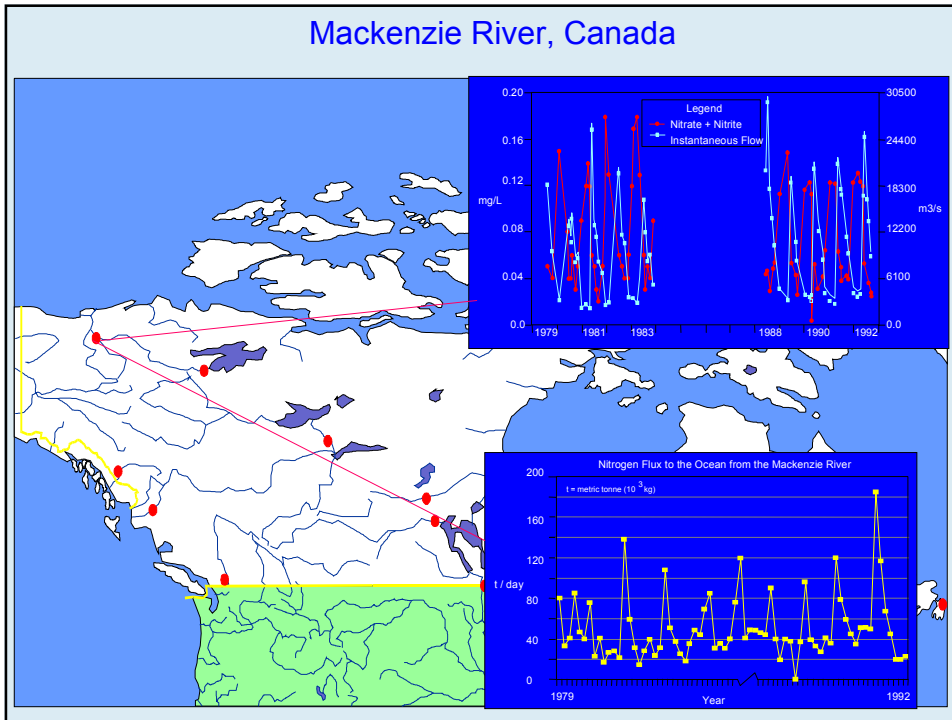
- **Data received in various formats**
 - Paper
 - Files received on diskette and not formatted
 - Files attached or embedded in email
- **Review of data and metadata**
 - Corresponding stations comparison
 - New parameter codes or change in analytical procedures
 - Identification of outlying values
- **Prepared and loaded into GLOWDAT – archive GEMS/Water database**
 - Main system editing filters to identify suspect data
 - Feedback loop with data originators
- **Download country data to GEMS/Water working files.**
 - On-going edit and database update activity

Longitudinal Profile of Chloride in the Nile River Basin

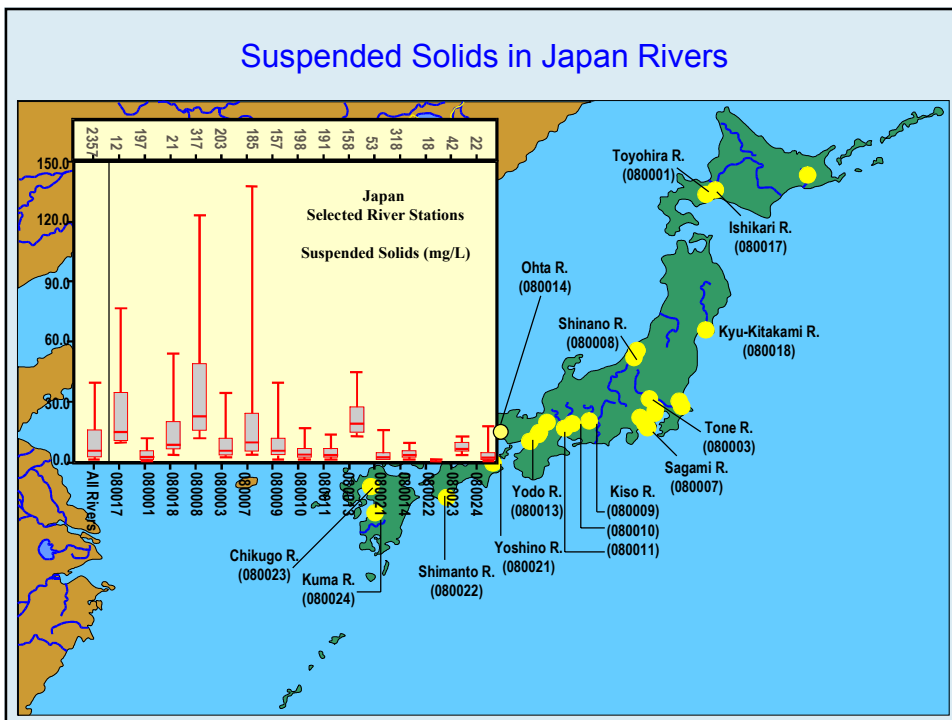


BOD vs COD Regression in the Banjir Canal, Djakarta, Indonesia

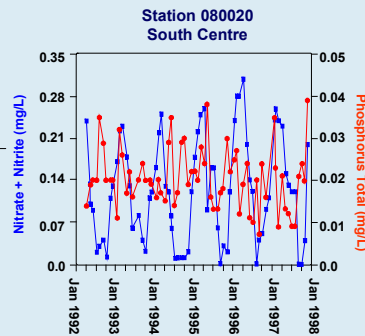
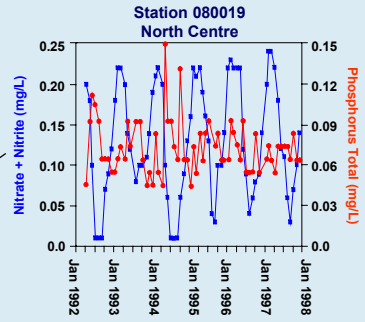
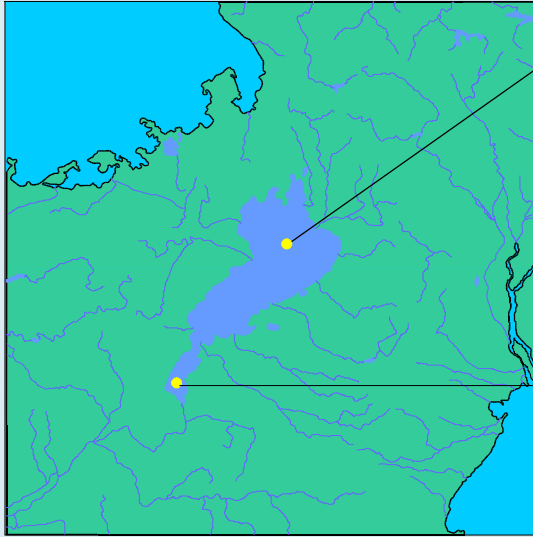
Mackenzie River, Canada



Suspended Solids in Japan Rivers

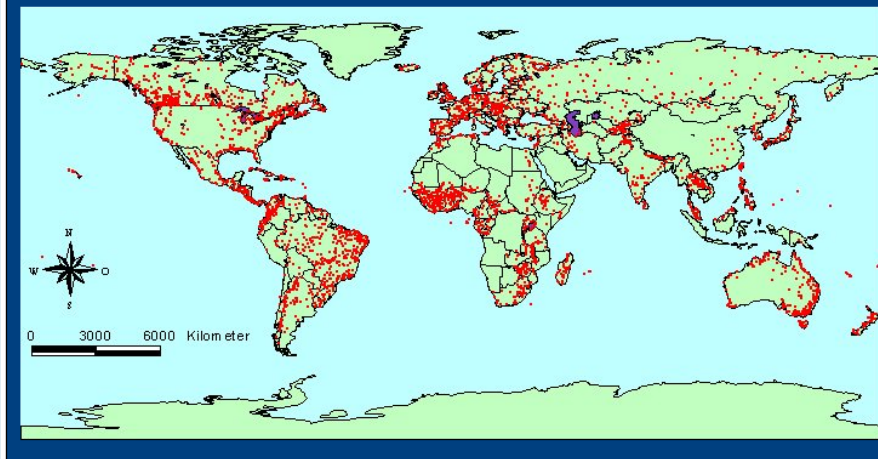


Lake Biwa, Japan

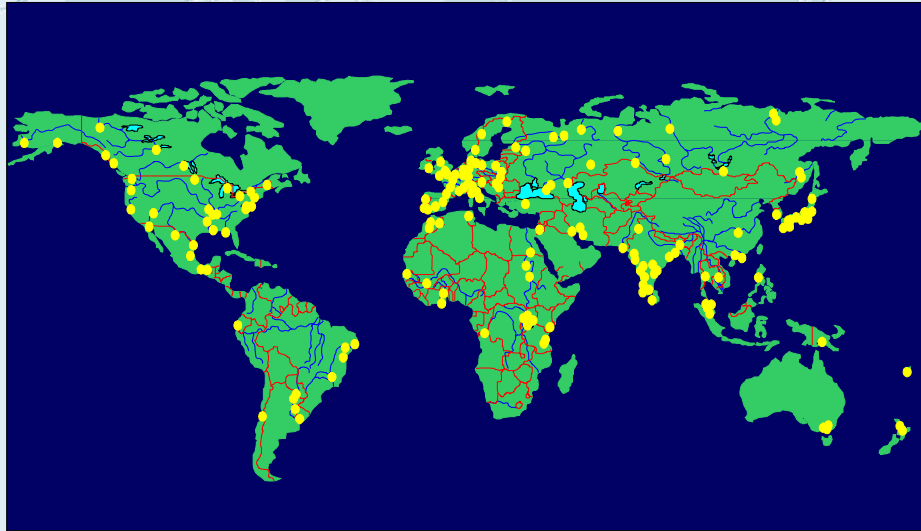


Global Runoff Data Centre Koblenz, Germany

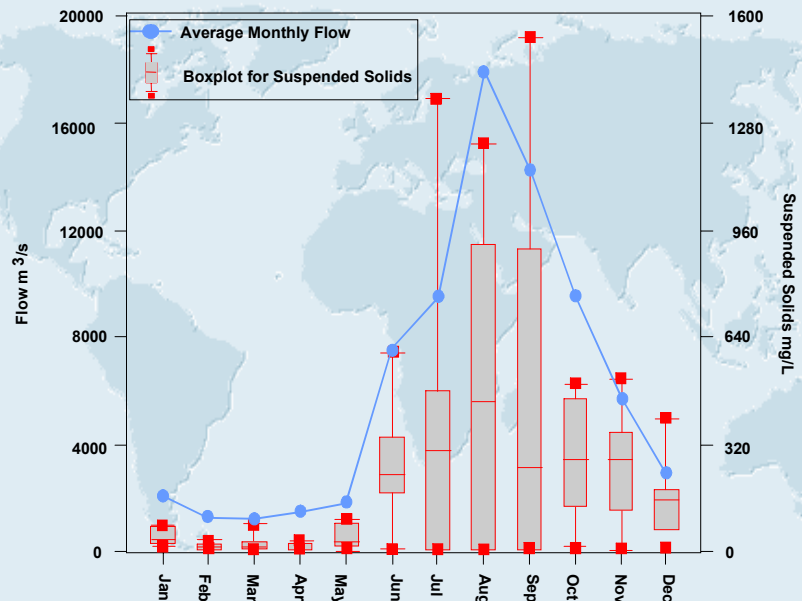
All GRDC Stations
Status 1998

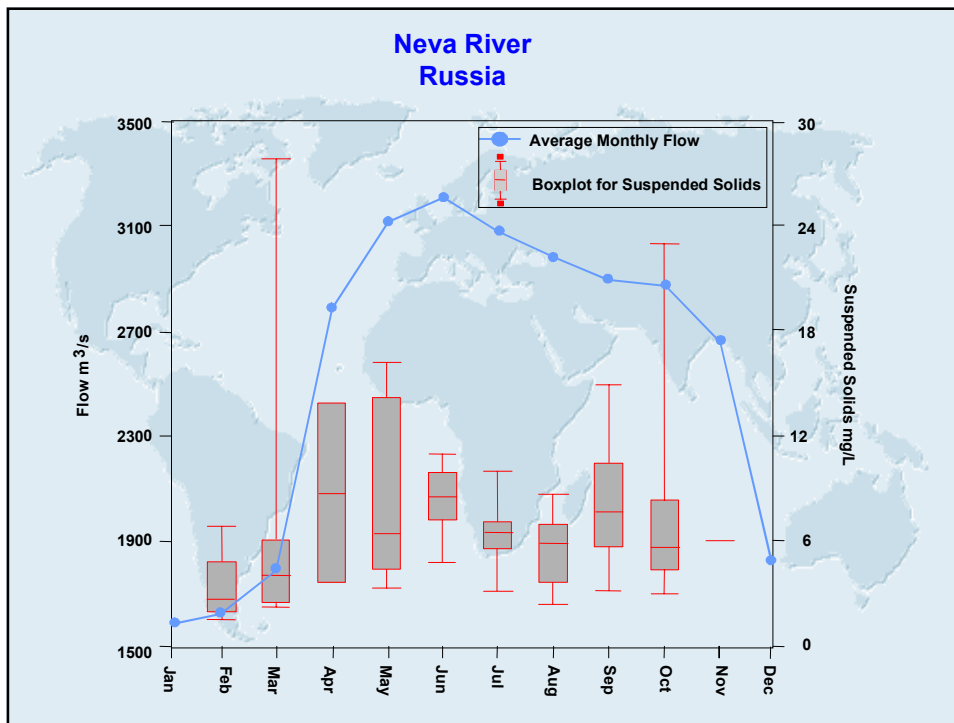


Corresponding GRDC and GEMS/Water Stations



Mekong River (Laos, Cambodia, Vietnam)





GEMS/Water Collaboration Partnerships for Freshwater Quality Assessment

- Enhanced co-ordination within UN system in the field of freshwater.
- Integration of GEMS/Water with other UN Programmes. (GIWA, GPA, GRDC, GEF, GTOS, GCOS, GEO, GTN-H, WWAP, POPS Convention)
- World Water Development Report (WWDR)
 - Data / Metadata
 - NFP Communications
 - Interpretation, Assessment and Expertise
 - On-going GEMS/Water operations for new information

Strengthening the Role of GEMS/Water

- Enhance GEMS/Water's role as a center of excellence in water quality monitoring and assessment.
 - Increase investment in GEMS/Water's infrastructure and capacity.
- Strengthening GEMS/Water within the UN system.
 - Expand GEMS/Water's global coverage, increase number of participating countries, increase number of reporting stations.
 - Increase collaborative activity with UN organizations and programmes.

...

Strengthening the Role of GEMS/Water

- Enhance GEMS/Water's leadership in international water quality monitoring and assessment.
- Apply new technologies to improve programme effectiveness leading to the identification of emerging issues.
- Through partnerships, increase GEMS/Water capacity building activities emphasizing developing countries.
- Redesign and implement the GEMS/Water QA/QC programme.

Annex 30

**Global Precipitation Climatology Centre
(GPCC): Operational Analysis of
Precipitation Based on Surface
Observations, Dr Rudolf, DWD**



The Global Precipitation Climatology Centre (GPCC): Operational Analysis of Precipitation Based on Surface Observations

Bruno Rudolf, Tobias Fuchs, and Udo Schneider
Deutscher Wetterdienst, Offenbach a.M., Germany
August 2001

1 Introduction

The GPCC has been established in 1989 on invitation of the World Meteorological Organization (WMO) as a German contribution to the World Climate Research Programme (WCRP). It is represented in the GEWEX Hydrometeorology Panel. It also operates the Arctic Precipitation Data Archive (APDA) for the Arctic Climate System Study (WCRP 1994). The Centre continuously supports the Global Climate Observing System (GCOS) by data availability monitoring and quality-control of the GCOS Surface Network precipitation data. Furthermore, the GPCC is a component of the GCOS/GTOS Terrestrial Network – Hydrology (GTN-H) (WMO 2000).

First of all, the GPCC is one of the major components of the Global Precipitation Climatology Project (GPCP). The common task of the GPCP is the compilation of global gridded precipitation data sets based on all globally available observation systems, i.e. conventional surface networks and various satellite-observed radiances. Besides GPCC, contributors to the GPCP are the satellite operators (EUMETSAT, JMA, NOAA, and NASA) and several research institutes. The products are designed for the global climate research community and are especially required for the verification of global climate models, the investigation of climate variability and special phenomena such as the El Niño - Southern Oscillation, and the determination of the Earth's water balance and budgets (WCRP 1990).

The scientific and technical functions of the GPCC comprise:

- Collection of conventionally measured precipitation data from surface-based networks.
- Quality-control of the data and correction of errors.
- Calculation of monthly gridded area-mean precipitation for the Earth's land surface.
- Error assessment for the area-mean results of each individual gridbox and month.
- Contribution to merging of surface-based observations and satellite data, performed at the GPCP Merging Development Center (NASA Goddard Space Flight Center) jointly with the other project participants.
- Climatological studies based on results of the above analysis.
- Development of advanced quality-control and analysis techniques.

Special activities with regard to the Arctic Climate System Study (ACSYS) are:

- Establishment and operation of the Arctic Precipitation Data Archive (APDA).
- Collection of daily precipitation and snow depth data for the Arctic hydrological basin.
- Analysis and evaluation of precipitation, snow depth and its liquid water equivalent.
- Intercomparison of gridded total precipitation, snow depth, and river discharge for the large rivers of the Arctic hydrological catchment area.

2 The Observational Database

Conventionally measured data from raingauge networks are still the most reliable information to obtain area-averaged precipitation for the landsurface. Satellite-based estimates are subject to larger biases and stochastic errors and need to be adjusted to in-situ observations (Barrett et al. 1994, Rudolf et al. 1996).

A first meteorological database for precipitation can be obtained from synoptically observed weather reports (at least with a daily resolution) and monthly climatic data, which are distributed worldwide as "SYNOP" and "CLIMAT" reports via the World Weather Watch Global Telecommunication System (GTS). GPCC regularly collects monthly precipitation totals from these sources for nearly 7,000 stations worldwide. These data being available near real-time are the basis for monthly monitoring of the global precipitation, i.e. the "Monitoring Product" of the GPCC.

The number of data being available from GTS is insufficient with regard to the sampling error and the quantitative reliability of analyses as requested (WCRP 1990). Thus the GPCC actively acquired additional data from individual national data originators (meteorological and hydrological network operators). So far, institutes from about 150 countries have supplied additional data, following bilateral negotiation with GPCC based on WMO recommendations. The entire GPCC database includes now monthly precipitation totals of about 48,000 stations (GPCC's full data set). The time series are largely complemented by climatological means for the normal period 1961-1990. The year with the best data coverage is 1987 with monthly precipitation data for about 38,000 stations. A gradual decrease of the number of stations from 38,000 in 1986-89 down to 7,000 stations for 1999 (which is the number of GTS data) is caused by the delay of the delivery of additional data and by the time required by the national agencies, and subsequently by GPCC for data processing and quality-control which is very important (Rudolf et al. 1998). The spatial distribution of the data also shows data poor regions.

GPCC's data collection period has been defined by the GPCP Implementation and Data Management Plan (WCRP 1990) to start with the year 1986. The database as compiled so far still needs spatial and temporal completion and continuous updating, as well as a retrospective temporal extension in order to cover historical periods (see section 7).

3 GPCC raingauge-based analyses of global land surface precipitation

The monthly GPCC products, gridded data sets based on raingauge observations, are available in two resolutions, 2.5° by 2.5° and 1.0° by 1.0° geographical latitude and longitude, and with two different databases, i.e. near real-time with GTS data only ("GPCC Monitoring Product" based about 7,000 stations) and non real-time including complemented GTS data and additionally the data, which are delivered later from national institutions to the GPCC ("GPCC Full Data Product" based on 30,000 to 40,000 stations).

Variables which are supplied with both products on the grid are:

- Monthly precipitation amount (mm/month);
- Mean monthly precipitation for the normal period 1961-90 (mm/month);
- Monthly precipitation deviation from normal 1961-90 (mm/month);
- Monthly precipitation anomaly (percentage of normal 1961-90);
- Number of raingauges per gridcell for estimation of the sampling error;
- Mean correction factors for the systematic gauge-measuring error.

GPCC's raingauge-based "Monitoring Product" is the in-situ data basis of the satellite-raingauge combined data sets of the GPCP (Huffman et al. 1997) as well as of CMAP (Xie & Arkin, 1997), and can be downloaded from internet (<http://gpcc.dwd.de>). The re-analysis of all collected data is going on in order to supply a "Full Data Product" to the planned ISLSCP Initiative II CDROM set.

4 Error Assessment

Area-means of precipitation derived from point data are contaminated by errors of different origin. These errors types first have to be treated and quantified separately, and the results then need be merged to a total error of the area-mean precipitation. The GPCC approach is described in the following:

1. Stochastic quality-related errors resulting from erroneous input data are minimized by a full high-level quality-control of all data used in the raingauge analysis.
2. Systematic measuring errors are climatologically compensated using long-term mean correction factors, which were derived by Legates (1987).
3. The sampling error has been investigated by GPCC using data from dense networks of Australia, Canada, Finland, Germany and USA (Rudolf et al. 1994).
4. The methodical error is much smaller than the sampling errors, and is neglected for large-scale GPCC analyses.

The total stochastic error on the grid is calculated from the individual error components, after systematic errors have been eliminated.

5 Regional validation of global satellite-based precipitation estimates

There is a strong demand from the international research community for analyses of daily precipitation. But it is not possible to derive a complete global land-surface analysis of daily precipitation from raingauge data, because of two major problems, the very limited availability of raingauge data on a daily time resolution, and the variation of daily observation time with the longitudinal zones. The GPCP operationally provides a new mostly satellite-based product of daily global precipitation on a 1° by 1° (<http://www.ncdc.noaa.gov/wdcamet-ncdc.html>). 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 (Rudolf and Rubel 2000, Rubel and Rudolf 2001).

6 The Arctic Precipitation Data Archive (APDA) of ACSYS

The Implementation Plan of the Arctic Climate System Study ACSYS, published by the World Climate Research Programme (WMO/WCRP 1994), called for the establishment of an Arctic Precipitation Data Archive (APDA). This archive was installed in 1996 within the Global Precipitation Climatology Center (GPCC) in Offenbach/Main (Germany). The main objective of the data archive is to support an understanding of the freshwater balance of the Arctic ocean, to provide an observational basis for research on climatic changes related to the hydrological regime of the Arctic zone, and for improving understanding of the role of the snow-albedo feedback in the functioning of the land-ocean-atmosphere system. APDA focuses on the period 1950-2000 and contains as far as available both daily and monthly as well as uncorrected and corrected precipitation data from all observation stations within the Arctic drainage basin.

The GPCC has successfully submitted a project proposal to the German Polar Research Programme (funding agency: Federal Minister for Education and Research of Germany) titled "Ausbau des Arktischen Niederschlagsdatenarchivs (APDA) und Entwicklung einer aktuellen Niederschlags- und Schneeklimatologie für die Arktis". The aims of this project are:

- Complementation of the Archive by additional data from surface networks, new satellite-derived precipitation data and ECMWF re-analysis results (ERA-40).
- Further development of an applicable method for correction of raingauge-measured precipitation data regarding the systematic gauge measurement error.
- Quality assessment based on statistical studies for the data being hold in the Archive.

- Development of a method using snow depth data to improve the climatological analysis of precipitation at GPCC.
- Verification of precipitation predictions of ERA-40 and the operational DWD model GME on the basis of APDA products.
- Development of an improved large-scale precipitation climatology for the Arctic catchment area on the basis of an overall view of all data.
- Continuation of the archive's service for ACSYS participants.

7 The CLIVAR-Related Project “Development of an observational climate data basis (Europe and global) and related statistical analysis with regard to climate variability on a decadal and centennial time scale (2001 – 2006)”

This project beginning in October 2001, jointly performed by GPCC and University of Frankfurt, includes the compilation of a comprehensive climatological data basis concerning precipitation, snow cover, surface air temperature (average and extremes), and mean sea level air pressure time series as well as indices describing atmospheric circulations such as NAO (North Atlantic Oscillation), AO (Arctic Oscillation) and SO (Southern Oscillation correlated with El Niño; ENSO). The time-series will cover the period from 1890 to 2000 on a monthly data basis. Later on in the project, also daily data will be collected and evaluated. The collection of past climate data will be founded on a number of already existing collections (GHCN, CRU, FAO, UNESCO etc.) which will be merged. A very important but time consuming task will be the quality and homogeneity control. After end of the project proposed, the observational data basis shall be routinely updated and completed.

Within a second part, the data set specified above will be object of a detailed statistical analysis. This aims at a diagnosis of observed global and European climate variability on a year-to-year, decadal and secular time scale including seasonal characteristics. The project plan follows the recommendations from CLIVAR (WCRP 1998), especially CLIVAR DecGen.

8 Summary

National institutes from about 150 countries have supplied raingauge-measured precipitation data on a voluntary basis, following WMO requests resp. recommendations and bilateral negotiations of GPCC and individual suppliers. The GPCC database includes monthly precipitation data from so far about 48,000 stations. The data collection activity continues for historical and coming data. However, GPCC is not licenced to distribute the supplied data to other users.

But the GPCC publishes gridded precipitation data sets for global landsurface on a monthly routine basis. The gridded products are freely accessible in two spatial resolutions, 1.0° by 1.0° and 2.5° by 2.5° geogr. lat./long., the GPCC has already started to prepare products of higher resolution.

Other GPCC's research subjects focus on:

- Improvement of the statistical basis and methods for quality-control and error assessment.
- Correction of raingauge-measured precipitation data due to systematic measuring errors.
- Development of a comprehensive global climatic data base merged from various data sources.
- Validation of precipitation estimates from satellite data and model reanalyses.
- Analysis of hydrometeorological conditions during and before major flood events.
- Comparison of precipitation and run-off data (with GRDC and Univ. of New Hampshire).

Further development of GPCC towards a contribution to CLIVAR and CliC is going on. The GPCC and APDA data bases will be complemented by historical and new data sets becoming available. The data and/or products will be of use for all of the WCRP major projects.

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More information is available from GPCC's Website in the Internet: <http://gpcc.dwd.de> .

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Annex 31

International Groundwater Resources

Assessment Centre (IGRAC),

Mr. Boswinkel, TNO

IGRAC International Groundwater Resources Assessment Centre

Netherlands Institute of Applied Geoscience TNO
- National Geological Survey

TNO

Jan-Anne Boswinkel



Importance of Groundwater

- **Groundwater is largest source of fresh water (90% of available reserves) with two distinct functions:**
 - Extremely significant source for urban and rural water supply and for irrigation
 - Providing dry weather river flows and sustaining wetland ecosystems
- **The use of groundwater resources has increased dramatically due to:**
 - Widespread distribution
 - High reliability during droughts
 - Modest development cost

Current Status of Assessment

- **Not enough attention has been paid internationally to monitoring resource and assessing its sustainability**
- **There is increasing evidence of deterioration of groundwater resources due to:**
 - Excessive pumping in relation to replenishment
 - Excessive contaminant discharges to the subsurface
- **There is a general lack of knowledge and unawareness about state of groundwater resources, consequences:**
 - Inadequate scientific basis for decision-making in groundwater resource management and protection
 - Inadequate data to represent the role of groundwater in regional and global water balances and chemical mass balance studies

Need for an International Centre

- **There is a clear need for an international centre, to be operated under the auspices of UNESCO and WMO, which will stimulate national efforts in groundwater monitoring and assessment**

Background

- **Fifth UNESCO/WMO hydrology conference Feb 1999:**
Consideration for Global Groundwater Information Centre
 - WMO: mandate to hydrological data collection
 - UNESCO: mandate to scientific/technological waterresources management
- **UNESCO IHP Bureau September 1999**
- **WMO Chy Working Group Applications December 1999**
- **NC's IHP/OHP (D+NL) February 2000**
- **WMO+ UNESCO + NC's + experts March 2000**
- **UNESCO IHP Resolution June 2000**
- **WMO Chy Recommendation November 2000**

Mission International Groundwater Resources Assessment Centre (IGRAC)

- **IGRAC will contribute to the assessment of the groundwater resources, in order to encourage the conjunctive use of groundwater and surface water and to clarify the impact of groundwater on the world's ecosystems**

Overall Objective IGRAC

- To include groundwater fully in the assessment of fresh water resources and to encourage the conjunctive use and sustainable utilisation of both groundwater and surface water

Key Activities

- Creation of a global information system on groundwater resources assessments with key supporting data
- Preparation of guidelines and tools for data collection and aquifer monitoring
- Dissemination and training in appropriate technologies
- Processing and assessment of monitoring data, in support of and in collaboration with national agencies
- Promotion of public awareness on the strategic importance of groundwater

Key Outputs

- An overview of the world's major aquifers, including their distribution, level of exploitation and their general functioning in relation to surface water
- A diagnosis of trends in hydraulic heads and water quality for the world's major aquifers

Principal Beneficiaries

- **Multinational and bilateral co-operation agencies:** IGRAC provides reliable information to facilitate prioritisation of investments in the water sector
- **Scientists:** IGRAC provides sound data to enable global environmental assessments
- **Local and regional water managers:** IGRC provides improved groundwater data on groundwater system status and behaviour

Targets for Initial Phase of Operation

- **Direct measurements on groundwater systems are costly and time-consuming**
- **Therefore, IGRAC's initial activities will focus on:**
 - Collation and review of information on groundwater resources activities primarily under the umbrella of UN-system organisations
 - Assessment of some selected key aquifers to determine, at reconnaissance level, their quality and quantity status and trends
 - Provision of the groundwater input to the proposed series of UN World Water Development Reports

What will IGRAC do

- IGRAC will collect, process and analyse basic data of aquifer systems ⇒ standardisation of monitoring methods
- IGRAC will facilitate technical and scientific exchange of knowledge and experience between countries
- Depending on third-party funding, IGRAC will support technical cooperation projects (groundwater monitoring, -assessment, -management)

What IGRAC will not do

- IGRAC will neither finance the development of monitoring infrastructure nor the operation of the infrastructure
- IGRAC will not develop and/or disseminate software on a commercial basis

Status of 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 the Recommendation CHy-XI-1, 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

Annex 32

**Integrated Global Observing Strategy,
summary information taken from the
IGOS homepage**



[IGOS homepage](#)

WHAT IS IGOS?

[What is IGOS?](#)

[Why an IGOS?](#)

[What does IGOS do?](#)

[Who are the users?](#)

[Who are the IGOS Partners?](#)

[How is IGOS implemented?](#)

The Integrated Global Observing Strategy (IGOS) unites the major satellite and surface-based systems for global environmental observations of the atmosphere, oceans and land.

What is IGOS?

- **IGOS** is a *strategic planning process*, involving a number of partners, that links research, long-term monitoring and operational programmes, as well as data producers and users, in a structure that helps determine observation gaps and identify the resources to fill observation needs.
- **IGOS** is a *framework for decisions and resource allocation* by individual funding agencies, providing governments with improved understanding of the need for global observations through the presentation of an overarching view of current system capabilities and limitations - thereby helping to reduce unnecessary duplication of observations.
- **IGOS** focusses primarily on the *observing* aspects of the process of providing environmental information for decision-making.
- **IGOS** is intended to cover *all forms of data collection* concerning the physical, chemical, biological and human environment including the associated impacts.
- **IGOS** is based on the recognition that data collection must be *user driven*, leading to results which will increase scientific understanding and guide early warning, policy-setting and decision-making for sustainable development and environmental protection.
- **IGOS** provides opportunities for *capacity building* and assisting countries to obtain maximum benefit from the total set of observations.

Why an IGOS?

The range of global observations needed to understand and monitor Earth processes, and to assess human impacts, exceeds the capability of any one country. Cooperation is therefore necessary to address priorities without duplication or omission. Satellite missions and *in situ* networks require many years of planning. Observations of the state of and trends in planetary processes cut across land, water, air and oceans. National programmes need to fit into larger international frameworks, since the environment does not stop at national boundaries. Such complex activities require integration at many levels. IGOS provides both a strategic framework and a planning process to bring together remotely-sensed and *in situ* observations, from both research and operational programmes.

Through IGOS, data suppliers can respond to requirements that have been set by users. Deficiencies are determined, resources identified, and observational programmes improved to ensure that observations are turned into useful products.

What does IGOS do?

The components of IGOS have considerable strategic importance, cutting across all observing activities. Major thrusts of IGOS as it proceeds will include:

- strengthening **space-based/in situ linkages** to improve the balance between satellite remote sensing and ground- or ocean-based observing programmes;
- encouraging the **transition from research to operational** environmental observations within appropriate institutional structures;
- improving **data policies** and facilitating data access and exchange;
- stimulating better **archiving of data** to build the long-term time series necessary to monitor environmental change; and
- increasing attention to **harmonization, quality assurance** and calibration/validation so that data can be used more effectively.

Who are the users?

IGOS encourages dialogue with the principal user groups and institutions to determine the needs for global environmental information for decision-making, including:

- **international decision-making bodies** such as the UN General Assembly, the Commission on Sustainable Development, and
- the conferences of parties and secretariats to international and regional **conventions**;
- **international organizations**;
- national **governments** and their relevant ministries;
- **decision-makers** and senior advisors;
- the **scientific community**, international research programmes, and international scientific advisory processes;
- the **private sector**;
- non-governmental and public service **organizations**;
- the **media**, journalists, and others specialized in communications;
- the general **public**, grass-roots users and major groups.

Who are the IGOS Partners?

IGOS is developed by a Partnership including the following:

- The Committee on Earth Observation Satellites (**CEOS**), which coordinates national agencies launching satellites.
- Integrated research programmes on global change within the World Climate Research Programme (**WCRP**) and the International Geosphere-Biosphere Programme (**IGBP**);
- The International Group of Funding Agencies for Global Change Research (**IGFA**).
- International agencies sponsoring global observations, including the Food and

Agriculture Organization of the United Nations (**FAO**), Intergovernmental Oceanographic Commission of UNESCO (**IOC**), International Council for Science (**ICSU**), United Nations Educational, Scientific and Cultural Organization (**UNESCO**), United Nations Environment Programme (**UNEP**), and World Meteorological Organization (**WMO**).

- The Global Climate Observing System (**GCOS**), the Global Ocean Observing System (**GOOS**), and the Global Terrestrial Observing System (**GTOS**), which organize global-scale operational observations of the climate, oceans and land surface.

The First IGOS Partners Meeting was held in June 1998, and meetings continue twice a year in association with CEOS Plenary sessions and meetings of the Sponsors Group for the Global Observing Systems.

How is IGOS implemented?

IGOS encourages the use of **modular approaches** to strategies for specific components that need to be integrated. The CEOS Strategic Implementation Team is taking the lead in developing the space component of an IGOS, while the G3OS and their sponsors are preparing an *in situ* component. These nested processes of strategic planning at different levels of integration are an important part of the IGOS process, allowing each subsidiary group to work out the specifics at its own level. IGOS itself helps to cap and interrelate these sub-components.

The IGOS partners have adopted a **thematic approach** with joint planning activities to address particular categories, cross-cutting themes or domains of observations, such as oceans, disaster management, or carbon storage and cycling.

Most environmental observations come from **national activities** contributed by national governments through their agencies and research programmes. Their commitment is essential to the effective implementation of IGOS. Building support for and participation in observing processes at the national level is a major activity for IGOS.

Six **prototype demonstration projects** have shown the benefits of an integrated strategic approach:

- Global Ocean Data Assimilation Experiment (GODAE);
- Upper Air Measurements;
- Long-term Continuity of Ozone Measurements;
- Global Observation of Forest Cover;
- Long-term Ocean Biology Measurements; and
- Disaster Management Support.

Each addresses a specific issue for an integrated observing strategy, requires a defined set of tools, associates a wide set of partners, and is expected to produce specific products or results to demonstrate the IGOS concept. These demonstration projects are now being integrated into the thematic approach to move the whole strategic process forward in a more coherent way.

Identification of **gaps to be filled** and activities to be strengthened is another continuing function of IGOS. The Global Observing Systems Space Panel (GOSSP) assists this process.

The IGOS process **promotes awareness** of the value of implementing IGOS and hence the need for resources to be made available at a relevant level. It demonstrates the benefits from integrated global observations in contributing to meeting the political objectives that have been set to improve the way we understand and manage the Earth.

Annex 33

WMO Resolution 21 (Cg-XII, 1995)



RESOLUTION 21 (Cg-XII, 1995)

GLOBAL RUNOFF DATA CENTRE (GRDC)

THE CONGRESS,

NOTING:

- (1) That the GRDC has its origins in support to the WCRP and to studies of large-scale hydrological processes,
- (2) The generous support that has been provided by Germany over many years for the establishment and maintenance of the Centre,
- (3) That the GRDC is now widely-recognized as the principal source of global data on river flows, providing an effective service to an increasing range of users,
- (4) That the Centre already cooperates in a number of major international projects,
- (5) That through its Resolution 11 (EC-XLV) - Report of the ninth session of the Commission for Hydrology, the Executive Council had approved Recommendation 2 (CHy-IX) - Support to global data centres,

CONSIDERING:

- (1) That new and increased demands are now being put on the Centre, in particular in relation to the global assessment of the world's water resources requested by the second session of the United Nations Commission on Sustainable Development (1994), the need for a global data centre in relation to WHYCOS, and for various climate studies,
- (2) That the Centre will need considerably more resources if it is to meet these new demands effectively,

RECOGNIZING that the GRDC is a major component of WMO's HWRP, serving also the WCRP and other programmes of the Organization,

ENCOURAGES Members:

- (1) To support the GRDC through the provision of the hydrological data and related information that it needs, including through the regional components of WHYCOS;
- (2) To consider also providing support to the Centre in the form of staff, funding, and other resources;

REQUESTS the president of the Commission for Hydrology to ensure that the Commission provides the GRDC with the scientific and technical advice that it requires;

REQUESTS the Secretary-General:

- (1) To invite other international organizations to cooperate with the GRDC, to make use of the services that it offers and to contribute both data and other resources in support of its operations;
- (2) To provide all possible support to the GRDC from available resources and to seek additional resources for this purpose from external sources.

Annex 34

WMO Resolution 25 (Cg-XIII, 1999)



RESOLUTION 25 (Cg-XIII, 1999)

EXCHANGE OF HYDROLOGICAL DATA AND PRODUCTS

THE CONGRESS,

NOTING:

- (1) Resolution 40 (Cg-XII) - WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities,
- (2) The inclusion of dedicated observations of the climate system, including hydrological phenomena, as one of the four main thrusts of The Climate Agenda, which was endorsed by Twelfth Congress,
- (3) That Technical Regulation [D.1.1] 8.3.1(k), states that, in general, the routine functions of NHSs should include, *inter alia*, "making the data accessible to users, when, where and in the form they require" and that the Technical Regulations also contain a consolidated list of data and product requirements to support all WMO Programmes,
- (4) That the nineteenth Special Session of the United Nations General Assembly agreed, in its overall review and appraisal of the implementation of Agenda 21, that there is an urgent need to "...foster regional and international cooperation for information dissemination and exchange through cooperative approaches among United Nations institutions, ..." (A/RES/S-19/2, paragraph 34(f)),
- (5) That the fifty-first session of the United Nations General Assembly adopted, by resolution 51/229, the Convention on the Law of the Non-navigational Uses of International Watercourses, Article 9 of which provides for "regular exchange of data and information",
- (6) That the Intergovernmental Council of the International Hydrological Programme of UNESCO adopted at its twelfth session Resolution XII-4 which dealt with the exchange of hydrological data and information needed for research at the regional and international levels,

CONSIDERING:

- (1) The significance attached by International Conference on Water and the Environment (ICWE) (Dublin, 1992) to extending the knowledge base on water and enhancing the capacity of water sector specialists to implement all aspects of integrated water resources management,
- (2) The call of world leaders at the United Nations Conference on Environment and Development (UNCED)(Rio de Janeiro, 1992) for a significant strengthening of, and capacity building in, water resources assessment, for increasing global commitment to exchange scientific data and analyses and for promoting access to strengthened systematic observations,
- (3) That the United Nations Commission on Sustainable Development (CSD) in its Decision 6/1 "Strategic Approaches to Freshwater Management" has strongly encouraged States to promote the exchange and dissemination of water-related data and information, and has recognized "the need for periodic assessments ... for a global picture of the state of freshwater resources and potential problems",
- (4) The call by the nineteenth Special Session of the United Nations General Assembly "for the highest priority to be given to the serious freshwater problems facing many regions,

especially in the developing world" and the "urgent need ... to strengthen the capability of Governments and international institutions to collect and manage information ... and environmental data, in order to facilitate the integrated assessment and management of water resources",

- (5) The requirements for full, open and prompt exchange of hydrological data and products in support of various international conventions, such as the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change, and the Convention to Combat Desertification,
- (6) The requirement for the global exchange of hydrological information in support of scientific investigations of world importance such as those on global change and the global hydrological cycle, and as a contribution to relevant programmes and projects of WMO, other United Nations agencies, ICSU and other organizations of equivalent status,
- (7) The opportunities for more efficient management of water resources and the need for cooperation in mitigating water-related hazards in transboundary river basins and their water bodies which depend on the international exchange of hydrological data and information,
- (8) The increasing recognition through scientific and technical endeavours, such as GEWEX, of the importance of hydrological data and products in improving the understanding of meteorological processes and subsequently the accuracy of meteorological products,

RECOGNIZING:

- (1) The responsibility of Members and their NHSs to provide for the security and well-being of the people of their countries, through mitigation of water-related hazards and sustainable management of water resources,
- (2) The potential benefits of enhanced exchange of hydrological data and information within shared river basins and aquifers, based on agreements between the Members concerned,
- (3) The continuing need for strengthening the capabilities of NHSs, particularly in developing countries,
- (4) The right of Governments to choose the manner by which, and the extent to which, they make hydrological data and products available domestically and internationally,
- (5) The right of Governments also to choose the extent to which they make available internationally data which are vital to national defense and security. Nevertheless, Members shall cooperate in good faith with other Members with a view to providing as much data as possible under the circumstances,
- (6) The requirement by some Members that their NHSs earn revenue from users, and/or adopt commercial practices in managing their businesses,
- (7) The long-established provision of some hydrological products and services on a commercial basis and in a competitive environment, and the impacts, both positive and negative, associated with such arrangements,

ADOPTS a stand of committing to broadening and enhancing, whenever possible, the free and unrestricted¹ international exchange² of hydrological data and products, in consonance with the requirements for WMO's scientific and technical programmes;

¹ "Free and unrestricted" means non-discriminatory and without charge. "Without charge", in the context of this resolution means at no more than the cost of reproduction and delivery, without charge for the data and the product themselves.

² "Exchange", in the context of this resolution, means the movement of data and product between countries or, as it is more likely in the case in the field of hydrology, the movement of data and product from one country to another.

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

- (1) Members shall provide on a free and unrestricted basis those hydrological data and products which are necessary for the provision of services in support of the protection of life and property and for the well-being of all peoples;
- (2) Members should also provide additional hydrological data and products, where available, which are required to sustain programmes and projects of WMO, other United Nations agencies, ICSU and other organizations of equivalent status, related to operational hydrology and water resources research at the global, regional and national levels and, furthermore, to assist other Members in the provision of hydrological services in their countries;
- (3) Members should provide to the research and education communities, for their non-commercial activities, free and unrestricted access to all hydrological data and products exchanged under the auspices of WMO;
- (4) Respecting (2) and (3) above, Members may place conditions on the re-export³, for commercial purposes, of these hydrological data and products, outside the receiving country or group of countries forming a single economic group;
- (5) Members should make known to all Members, through the WMO Secretariat, those hydrological data and products which have such conditions as in (4) above;
- (6) Members should make their best efforts to ensure that the conditions placed by the originator on the additional hydrological data and products are made known to initial and subsequent recipients;
- (7) Members shall ensure that the exchange of hydrological data and products under this resolution is consistent with the application of Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities;

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

- (1) Make their best efforts to implement the practice on the international exchange of hydrological data and products, as described in **FURTHER ADOPTS** (1) to (7);
- (2) Assist other Members, to the extent possible, and as agreed upon, in developing their capacity to implement the practice described in **FURTHER ADOPTS** (1) to (7);

REQUESTS the Executive Council to:

- (1) Invite the Commission for Hydrology to provide advice and assistance on technical aspects of the implementation of the practice on the international exchange of hydrological data and products;
- (2) Keep the implementation of this resolution under review and report to Fourteenth Congress;

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

³ "Re-export", in the context of this resolution, means to redistribute, physically or electronically, outside the receiving country, group of countries forming a single economic group, or regional and global data centres, directly or through a third party.

Annex 35

Data policies and data exchange, Dr Grabs

Concepts for the exchange of hydrological information

The international dissemination of hydrological information does not have a long history and many nations are simply hesitating to allow access to data because potential gains and perceived losses cannot be judged with confidence. The latter can be largely attributed to an insufficient exchange of national experiences in data exchange and the insufficient recognition of the positive national feed-backs when hydrological data is shared on a regional and global basis. In the view of the GRDC, two major concepts to the exchange of hydrological data can be identified:

- a) The concept that **data acquired from public funds** in a civil service structure should be **freely accessible and unrestricted** for the benefit not only to the national population (who paid indirectly for the data acquisition with their tax contribution), but also to the scientific community whose research results are regional or even global in nature so that a trans-national benefit can be achieved. Access to and exchange of information is also perceived as a confidence building measure between and across nations.
- b) The concept that **hydrological data are crucial for the socio-economic development of a nation**. Therefore it is perceived as politically important that data should be **protected from improper use**. This could be e.g. in the case of conflicting interests between riparian countries or in a situation where decision-makers suspect that the access to hydrological information would indirectly reveal internally sensitive issues such as power production, industrial development, agricultural production etc.

From Grabs, 1997 (FRIEND-conference, paper no. 159):

Models for information transfer

Four basic models for the transfer of hydrological data are identified in this paper:

- a) Dissemination of data and products to **identified users**. This would mean a controlled access. From the experience of the GRDC this approach has helped a lot to network researchers who work in related fields and is able to make use of synergistic potentials in research which are less evident with an anonymous access to data and products. This approach also supports the information need of data providers who need feedback as to who is using the data for which purposes and thus underlines the participatory approach of data providers in information processing. This approach requires "User rules" which regulate the dissemination of data.
- b) Dissemination of the data through the **Internet**: This **provides free, unrestricted, uncontrolled access** except perhaps for commercial purposes. This model requires least administration efforts and follows the "Freedom of Information" - philosophy of the United States. It also allows the widest possible dissemination of the data and products. There is no need felt to monitor who is using the data in what context and for what purpose. The data providers do not have feedback on the use of the data. The data may be used without reference of the source and update verification.
- c) Dissemination of data for **project participants only**, until the project has proceeded to a stage where the project participants decide to make data and results public. This approach is close to the data transfer policy of UNESCO's regionally implemented programme Flow Regimes from International and Experimental Network Data (FRIEND). The assembly of global data sets and the principle of free and indiscriminatory access to data are difficult to achieve.
- d) **Case-to-case decision** which datasets are open and which datasets should have a controlled access. This model takes into account that many datasets may already be public domain (e.g. data from historic archives etc.) and others are restricted for use only for defined purposes. The practical implementation of this model in a daily routine is **problematic from an administrative point of view**.

Though there is a common understanding that data should be provided free for research, it becomes increasingly difficult to distinguish between research and applications as much of today's research is application-oriented: It is a good assumption that many of the expensive global research programmes are funded because of the awareness of funding agencies of the potential or even immediate socio-economic value of the research.

Whereas the "free access" model follows the example of the United States, European countries tend to operate various schemes of differential charging of data which has been an effective regulation instrument in terms of use and access to data. Where the cost of data and its inherent value is becoming apparent in this way, cash-scarce programmes and participants especially in developing countries cannot afford research. In a drive for the commercialisation of services, costs emerge as an effective barrier to access hydrological data.

Annex 36

Abstracts of GRDC reports 25 and 26

GRDC Report 25
June 2000**GIS-related monthly Balance of Water Availability and
Water Demand In Large River Basins**

Case study for the River Danube

Irina Dornblut

Global Runoff Data Centre, Koblenz, Germany

Summary

The Global Runoff Data Centre (GRDC) at the German Federal Institute of Hydrology (BfG) combined available methodological tools and generally accessible data and information to establish methodological principles for short-range modelling of water availability/demand balances in large international river basins in the light of growing water demands. The core of such a balance is the location- and time-related comparison of available resources with water demands in the river basin, while the underlying methodology is an in-depth balancing by means of a long-term water management model on the basis of the Monte-Carlo technique.

The Pilot Study GRM Danube has proven at the example of the River Danube the applicability of the program system ArcGRM to the modelling of a water-management balance of available resources and water demands in large international river basins. The advantages of the system consist in the location- and time-related balance of resources and demands under consideration of the operation of storage reservoirs. It allows to take into account diverse water uses and demands in their temporal and spatial variability. Integrating of FORTRAN instructions allows to vary and supplement the standard algorithms of the program system in form of "dynamic elements". Thus, demand functions may be adapted individually, and qualitative or economic parameters, interactions with groundwater or flow-times in the river system may be considered.

The monthly balancing step makes it possible to evaluate the satisfaction of demands both in the annual averages and in the variations during the year. The outputs of the balancing procedure may be exceedance probabilities of events at any point along the river course, durations of events, mean values and mean minima and maxima of monthly streamflow.

The River Danube is used here to demonstrate the applicability of the program system *ArcGRM* for a availability/demand balance in large basins. This balance examines the satisfaction of present and future water demands in the Danube basin, assuming constant resources, against the background of changed water uses after 1990. The summative decrease of water consumption in countries in the Danube basin after 1990 results in improvements of the potential safety of supplies, which is illustrated here with the required minimum streamflow for navigation.

The program system is flexible and readily applicable provided the necessary input data are available. Hydrological inputs are externally generated time series of monthly streamflow obtained by statistical analyses of time-coordinated observations. The main problem is the acquisition of plausible and reliable data describing the anthropogenic impacts on the hydrological system. If the quantification of the effects of storage reservoirs, water transfers, uses and demands relies on generally available data sources, it is necessary to transfer the given data from country scale to basin scale by means of Geographic Information Systems (GIS).

Balancing of water availability and water demand at selected points in the basin, under consideration of storage reservoir operation, allows to identify cases of surplus and deficit in the satisfaction of the diverse water demands as well as potential risks regarding the potential safety of supplies. Proceeding from the basic version, additional variant computations can examine the impacts of future developments in water uses or large-scale changes of resources availability on the satisfaction of demands and may analyse predicted trends in water demands.

The presented methodological steps allow to set-up a basic model for the selected basin and to use it for short-range computations of varying management scenarios. Such model outputs may be used for global and regional monitoring of areas of (potential) water crises, and the summarized information may help to establish general principles for the management of large international river basins that are affected by permanent water scarcity, high population growth, and increasing water consumption. For applications in "rapid assessments" at regional levels in the context of international programmes, the presented methodology needs formalization by defining separate work steps and simultaneously detailed adjustments to the regional conditions.

GRDC Report 26
November 2000

Modelling raster-based monthly water balance components for Europe

Carmen Ulmen

SUMMARY

With the objective of providing raster-based runoff for coupled ocean-atmospheric General Circulation Models the water balance model WABIMON, based on the approach of THORNTHWAITE & MATHER (1957), is applied, improved, calibrated and validated for Greater Europe. The model works in a monthly time step and on a horizontal resolution of 0.5° longitude and 0.5° latitude. Input data sets of precipitation and temperature are given as long-term monthly means of the period 1961-90. GIS-based information are required on mean elevation, slope steepness, water holding capacity of the soil, and the recession constant. The model computes potential and actual evapotranspiration as well as total runoff, consisting of the components of base flow, surface and snow melt runoff. The modules computing snow cover accumulation, snow melt, surface runoff and the soil water balance are extended within the frame of this study. For model validation measured catchment-based runoff of 29 European test catchments is used. The evaluation of the model quality occurs with the help of the Sutton-Rathcliffe coefficient (model efficiency, ME), which is defined within the interval $[-\infty, +1]$ positive values of this parameter the residual variance is lower than the variance of all observed data, so that the model can be said to work effectively. The ME of the Finnish Kymijoki basin and the Spanish Júcar basin were so negative due to the retention effect of the Finnish plain of lakes and reservoir management respectively that they had to be excluded from further model calibration. The area-weighted arithmetic mean of the individual ME is still negative although for 16 of the remaining 27 European test catchments a positive ME is reached. The positive median does not exceed zero significantly. This hypothesis had to be retained on the 5 %-level in a parameter free median test. This is partly caused by the fact that the basins with a positive ME cover a greater area than those with a negative ME, but the possibilities of performing the median test in an area-weighted manner are restricted. In addition, High Mountain basins, where the ME was worst, are numerically over-represented in the sample. Most important reasons for high residuals are too low a precipitation input data due to measurement errors in snowy regions, reservoir management, the retention effect of lakes and marshes and the underestimation of potential evapotranspiration in the Mediterranean by the very simple Thornthwaite formula. In High Mountains the annual water balance is not always outweighed since the model structure does not guarantee that the snow cover accumulated during the winter months melts completely in summer.

The model produces most satisfactory results for maritime regions with pluvial runoff regimes, pluvio-nival regimes of low mountains, and the vast areas of nival lowland regimes. WABIMON is quite



**Selected abstracts
of recent
GRDC-Reports**



Federal Institute of Hydrology

Global Runoff Data Centre

reliable there concerning the general temporal and spatial distribution of runoff. But the model results should not be interpreted on the individual grid level as the model has not been proven to provide satisfactory accuracy there yet. Before using WABIMON model results as input for GCMs, the model structure should further be improved and validated. If the gridded runoff fields are still used as GCM input, it has to be considered that runoff is underestimated in the High Mountains, overestimated in the southern Mediterranean and that the data set is completely unreliable in regions of great lakes, marshes and managed reservoirs.

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

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Annex 37

**Information note on GRDC as published
in the May 2001 issue No.72 of the IAHS
newsletter**

Ministry of Aviation. In fact the excellent administrative and logistical support was provided jointly by the Department of Hydrology and Hydrogeology, headed by Mr J. A. Hanidu, and the Nigeria Meteorological Services, headed by Mr Y. Salahu, in the true spirit of cooperation between Meteorological and Hydrological Services that is a strength of WMO.

This cooperation was exemplified at the opening ceremony, which was combined with that of the Sixth WMO Technical Conference on Management for Development of Meteorological Services in Africa that was held at the ECOWAS Centre in Abuja from 6 to 10 November 2000. The ceremony was addressed by senior officials of the Federal Government and by Professor G. O. P. Obasi on behalf of WMO. The Secretary to the Federal Government presented an address on behalf of His Excellency Chief Olusegun Obasanjo GCFR (Grand Commander of the Federal Republic), President of Nigeria. The occasion also saw the presentation of a certificate for outstanding service to Mr M. A. Kohler (USA), the first President of CHy's predecessor, the Commission for Hydrological Meteorology from 1959 to 1968.

The Commission's session was attended by 90 participants representing 50 members of WMO and nine intergovernmental and nongovernmental organizations. It received reports from its three working groups and reviewed all aspects of WMO's Hydrology and Water Resources Programme. In particular, it made recommendations concerning the implementation of Resolution 25 (Cg-XIII)—Exchange of hydrological data and products, and provided inputs to the development of WMO's Sixth Long-term Plan and ongoing discussions on the structure of the Organization.

The meeting was chaired by Prof. K. Hofius (Germany), President of CHy, assisted by its Vice-President, Mr D. Rutashobya (Tanzania). The more detailed discussions were held in two working committees chaired by Messrs D. Rutashobya and B. Stewart (Australia), assisted by Ms G. Wennerberg (Sweden) and A. Terakawa (Japan) as Vice-Chairs.

The need for inter-agency cooperation at national and international levels was frequently raised, one good example being the proposal for the establishment of an International Groundwater Resources Assessment Centre. The Commission adopted a recommendation strongly supporting this proposal which mirrored one adopted by the Intergovernmental Council of the IHP of UNESCO a few months previously.

The Commission also kept in force recommendations concerning global databases and hydrological networks, and that on the participation of women adopted at its previous session. It regretted that the number of women

involved in CHy activities had not increased in recent years and was therefore particularly pleased to be able to include three women in the working groups that it established to undertake work on its behalf over the next four years.

In addition to the Advisory Working Group, CHy established a Working Group on Water Resources Assessment and a Working Group on Forecasting and Prediction, comprising 20 individual experts in total.

It was very appropriate that, as this was its first session to be held in Africa, the Commission elected Mr D. Rutashobya to the office of President of CHy. Mr B. Stewart chair of the previous CHy Working Group on Basic Systems, was elected to the post of Vice-President.

At the close of the meeting, tributes were paid to Prof. Hofius for his exemplary leadership of the Commission over the previous eight years and to Nigeria for its support to WMO, in particular the Commission session, and the hospitality it had shown to all attending the session.

Arthur Askew



The Global Runoff Data Centre

Since July 2000 the Global Runoff Data Centre (GRDC) has been headed by Dr Thomas Maurer (thomas.maurer@bafg.de), a hydraulic engineer and hydrologist, experienced in the field of hydroinformatics. He took over from Dr Nestor Correa and his predecessor Dr Wolfgang Grabs who moved to WMO headquarters in December 1999.

We would like to take this opportunity to recall briefly the background and mission of GRDC.

Introduction

A global hydrological database is considered essential for research and application-oriented hydrological and climatological projects at global, regional and basin scales. This includes water balance studies, investigation of trends in long-term hydrological time series, coupling of hydrological and meteorological models, flux of freshwater and pollutants into the oceans, and the coupling of runoff with water quality data. Monitoring of runoff is indispensable for water resources planning and management on all scale levels.

The principal objective of GRDC is to collect and disseminate hydrological data to support projects within the World Climate Programme (WCP) and the World Climate Research Programme (WCRP) of the World Meteorological Organization (WMO) as well as for other programmes such as the World Hydrological Climate Observing System (WHYCOS) of WMO and the World Bank and the Global Environment Monitoring System—Water (GEMS-Water) of UNEP and WHO. The Centre provides a mechanism for the international exchange of data pertaining to river flows on a continuous, long-term basis. The scope of data collection is global, regional and on catchment scale.

GRDC's position in the UN system

Operating under the auspices of WMO gives GRDC the UN mandate and an identity with regard to the United Nations system which is essential for its international recognition. Hydrological and Meteorological Services of members of WMO on a multilateral and bilateral basis are the principal data providers for GRDC.

At its Twelfth Congress in 1995, WMO adopted Resolution 40 (Cg-XII) and thus committed itself, as a fundamental principal, "to broadening and enhancing the free and unrestricted international exchange of meteorological and related data and products". In this context, "free and unrestricted" means non-discriminatory and without charge, the latter with the meaning "at no more than the cost of reproduction and delivery, without charge for the data and products themselves". With regard to the Global Runoff Data Centre, Congress also adopted Resolution 21 (Cg-XII) which encourages members (countries) "to support GRDC through the provision of the hydrological data and related information that it needs".

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

regional and international levels ... using the internationally recognized international data centres".

More recently, at its Thirteenth Congress in 1999, the WMO adopted Resolution 25 (Cg-XIII) which extended and specified the commitment of Resolution 40 (Cg-XII). "Members shall provide on a free and unrestricted basis ..." (a) "... those data and products which are necessary for the provision of services in support of the protection of life and property and for the well-being of all peoples"; (b) "... additional data and products ... which are required to sustain international programmes and projects related to operational hydrology and water resources research ..." and further (c) "... all hydrological data and products exchanged under the auspices of WMO ... to the research and education communities, for their non-commercial activities".

GRDC's organizational set-up

The Centre is funded by the government of the Federal Republic of Germany. It was formally established at the Federal Institute of Hydrology in Koblenz, Germany, in 1988. For more information contact:

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The Hydrology and Water Resources Programme (HWRP) in WMO is the professional contact partner for the Centre. The activities of the Centre are monitored by the international Steering Committee of GRDC which provides advice on the functions of GRDC, policy matters, data acquisition, services and the implementation of various tasks.

GRDC's data collection principles

General criteria for data collection are: data should be collected for rivers which reflect the hydrological regime of a region or part of a country, rivers which are economically important in terms of population density and/or agro-based or industrial production and those rivers which drain into the oceans or have an internal drainage. Preferably mean daily discharge data of good quality and long time series of discharge are favoured for entry into the database.

As a principal GRDC policy, the responsibility for the quality of data lies with the national hydrological services. The Centre performs plausibility tests and communicates with the data providers.

GRDC's data and services

The Centre operates on the basis of a state-of-the-art Databank Management System which ensures fast data entry and retrieval services, complex

queries and fast response to data requests. The database is continuously updated. So far, approximately 150 countries have contributed to the development of the database which now consists of data from over 3700 stations monitoring about 3000 rivers worldwide. The database thus comprises about 60 000 station-years of daily and 100 000 station-years of monthly discharge values, i.e. average time series length of 20–30 years. Within its limited resources GRDC also offers a range of advisory services to national hydrological services as an incentive to provide data. Furthermore, collaboration in the field of database technology is offered to national and international organizations.

The Centre provides users with information for the proper selection of data with regard to the objectives of the client. The collection of project databases and the provision of data products is performed on request. An important service is the feed-back information for the national hydrological services about the use of the data. The GRDC catalogue can be downloaded from the GRDC homepage:

<http://www.bafg.de/grdc.htm>

The Centre encourages researchers to use the GRDC database for studies and research in direct collaboration with the Centre and the Centre is prepared to invite and accept guest researchers.

Thomas Maurer

HKH-FRIEND (Hindu Kush-Himalayan FRIEND)

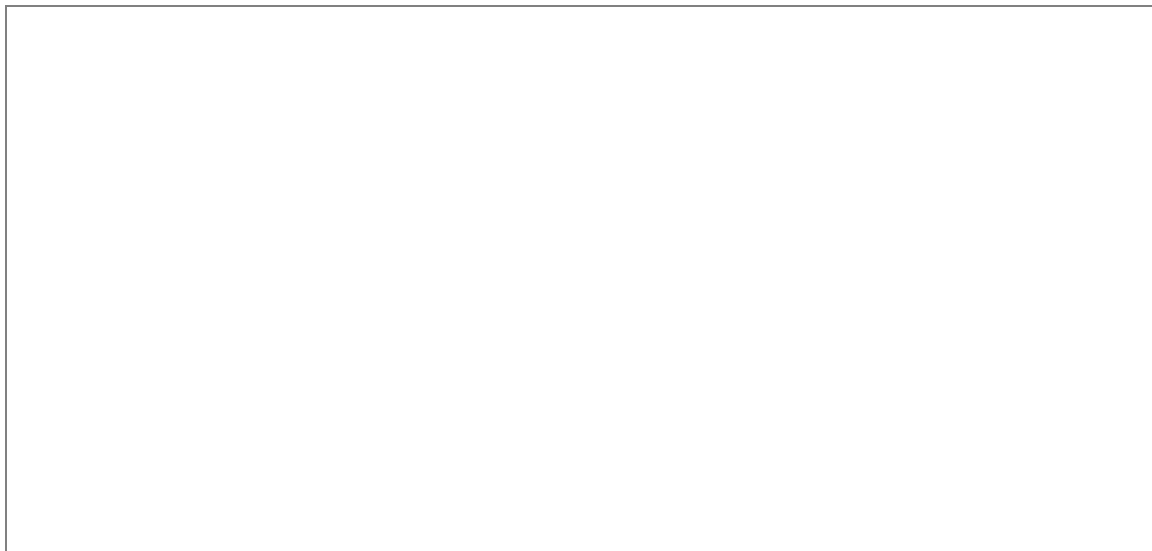
HKH-FRIEND/ICSI Workshop on the Development of a Snow and Glacier Mass Balance Manual

The Workshop on the Development of a Snow and Glacier Mass Balance Manual was organized

by the Snow and Glacier Group of HKH-FRIEND in collaboration with the IAHS International Commission on Snow and Ice (ICSI) and held at the International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal, from 20 to 24 March 2001. Financial support for this workshop was received from UNESCO/IHP and ICIMOD. The major objectives of the workshop were to finalize the table of contents of a training manual on snow and glacier mass balance measurements/studies in the HKH region and to delegate responsibilities for the preparation of the manual. The workshop was attended by 21 participants from Austria, Canada, China, India, Japan, Nepal, USA, UNESCO and ICIMOD which included experts from ICSI and the HKH-FRIEND Snow and Glacier Group. The participants included Prof. H. G. Jones, ICSI President-Elect, and Dr G. Kaser, Secretary of ICSI. Mr A. P. Pokhrel, Director General, Department of Hydrology and Meteorology of HMG-Nepal is the coordinator of the Snow and Glacier Group of HKH-FRIEND. The workshop programme included a field visit to the headwater regions of snowfed rivers in Nepal including one at Kodari, on the border between Nepal and the Tibetan Autonomous Region of China.

The workshop provided a good opportunity for the participants to review modern and conventional methods of glacier mass balance measurement. The future course of action was decided as follows:

- Identification of the glaciers for monitoring mass balance measurements in the HKH region according to the selection criteria set during the meeting.
- Preparation of a training manual on glacier mass balance measurement for the HKH region using standard methods as identified during the workshop.



HKH-FRIEND/ICSI Workshop participants, March 2001.

Annex 38

List of acronyms and associated URLs

List of acronyms and associated URLs

Status: November 2002

ACSYS	Arctic Climate System Study	http://acsys.npolar.no/
ARDB	Arctic Runoff Data Base	http://www.bafg.de/grdc.htm
AWG	Advisory Working Group	http://www.wmo.ch/web/homs/chy/awg.html
BALTEX	Baltic Sea Experiment	http://w3.gkss.de/baltex/baltex_home.html
BfG	Bundesanstalt für Gewässerkunde (Federal Institute of Hydrology)	http://www.bafg.de/
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economic Cooperation and Development)	http://www.bmz.de/en/index.html
CEB	Chief Executives Board	http://ceb.unsystem.org/
CEH	Centre for Ecology and Hydrology	http://www.ceh.ac.uk/
CEOP	Coordinated Enhanced Observing Period	http://monsoon.t.u-tokyo.ac.jp/ceop/index.html
CESR	Center for Environmental Systems Research	http://www.usf.uni-kassel.de/usf/
Cg	WMO Congress	
CHy	Commission for Hydrology	http://www.wmo.ch/web/homs/chy/chy.html
CliC	Climate and Cryosphere	http://clic.npolar.no/
CRU	Climatic Research Unit	http://www.cru.uea.ac.uk/
CSEs	Continental Scale Experiments	http://www.gewex.org/projects.html
DCP	data collection platform	
DMIP	Data Management and Information Panel	http://acsys.npolar.no/Oelke/adis_dmip.html
DMS	document management system	
DMWG	Data Management Working Group	http://www.joss.ucar.edu/ghp/
DWD	Deutscher Wetterdienst (German Weather Service)	http://www.dwd.de
EC	Executive Council (e.g. LIII = 53 rd session)	
EC-AGE	Executive Council Advisory Group on the International Exchange of Data and Products	report at http://www.wmo.ch/web/pla/
ECMWF	European Centre for Medium-Range Weather Forecasts	http://www.ecmwf.int/
EFFS	European Flood Forecasting System	http://effs.wldelft.nl/
ERB	European Network of Experimental and Representative Basins	http://www.ih.savba.sk/ihp/friend5/erb7.htm http://mujweb.cz/www/mutls/
ETOPO5	5 Min Gridded Earth Topography Data	http://edc.usgs.gov/glis/hyper/guide/etopo5
EU	European Union	http://europa.eu.int/
FGGE	First GARP Global Experiment	http://www.meteo.ru/fund/pgepe1.htm
FRICS	Foundation Of River & Basin Integrated Communications	www.river.go.jp (in Japanese), see also http://www.mlit.go.jp/river/english/index.html

FRIEND	Flow Regimes from International Experimental and Network Data	http://www.nwl.ac.uk/ih/www/research/bfriend.html
G3OS	The three Global Observing Systems (GCOS, GOOS and GTOS)	http://earthwatch.unep.net/data/g3os.html
GAME	GEWEX Asian Monsoon Experiment	http://www.ihis.nagoya-u.ac.jp/game/index.html
GARP	Global Atmospheric Research Programme	
GCIP	GEWEX Continental-scale International Project	http://www.ogp.noaa.gov/mpe/gapp/gcip
GCOS	Global Climate Observing System	http://www.wmo.ch/web/gcos/gcoshome.html
GEMS	Global Environmental Monitoring System	
GEMS/Water	Global Environmental Monitoring System / Freshwater Quality Programme	http://www.cciw.ca/gems
GEWEX	Global Energy and Water Cycle Experiment	http://www.gewex.org/
GEWINET	German Water Information Network	http://www.globwinet.org/germany.asp
GHCN	Global Historical Climatology Network	http://cdiac.esd.ornl.gov/ghcn/ghcn.html
GHP	Gewex Hydrometeorology Panel	http://www.usask.ca/geography/MAGS/GHP/ghp.html
GIS	Geographic Information System	
GIWA	Global International Waters Assessment	http://www.giwa.net
Global-RIMS	Global Rapid Integrated Monitoring System (for Water Cycle and Water Resource Assessment)	
GLOBWINET	Global Water Information Network	http://www.globwinet.org/
GOOS	Global Oceanic Observing System	http://ioc.unesco.org/goos/
GPCC	Global Precipitation Climatology Centre	http://www.dwd.de/research/gpcc/
GPCP	Global Precipitation Climatology Project	http://orbit-net.nesdis.noaa.gov/arad/gpcp/
GRDB	GRDC Database	http://www.bafg.de/grdc.htm
GRDC	Global Runoff Data Centre	http://www.bafg.de/grdc.htm
GTN-H	Global Terrestrial Network for Hydrology	http://www.gosic.org/gtos/GTNET-H_program_overview.htm
GTOS	Global Terrestrial Observing System	http://www.fao.org/gtos/
GTS	Global Telecommunication System	http://www.wmo.ch/web/www/TEM/gts.html
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)	http://www.gtz.de/english/
GWCC	GEMS/Water Collaborating Centre	http://www.cciw.ca/gems
GWP	Global Water Partnership	http://www.gwpforum.org
HELP	Hydrology for the Environment, Life and Policy	http://www.nerc-wallingford.ac.uk/ih/help/
HKH	Hindu Kush-Himalayan	http://www.nwl.ac.uk/ih/www/research/bfhkh.html
HLCP	High Level Committee on Programmes	http://ceb.unsystem.org/hlcp/default.htm
HWRD	Hydrology and Water Resources Department of WMO	http://www.wmo.ch/web/homs/
HWRP	Hydrology and Water Resources Programme of WMO	http://www.wmo.ch/web/homs/
HYCOS	Hydrological Cycle Observing System	http://www.wmo.ch/web/homs/projects/whycos.html
HYDRO1K	HYDRO1k Elevation Derivative Database	http://edcdaac.usgs.gov/gtopo30/hydro

IACSD	Inter-Agency Committee on Sustainable Development	http://www.un.org/esa/sustdev/iacsd.htm
IAEA	International Atomic Energy Agency	http://www.iaea.org/
IAHS	International Association of Hydrological Sciences	http://www.cig.enscm.fr/~iahs/index.htm
ICOLD	International Commission on Large Dams	http://www.icold-cigb.org/
ICSU	International Council for Science *	http://www.icsu.org/
IGOS	Integrated Global Observing Strategy	http://www.igospartners.org
IGRAC	International Groundwater Assessment Centre	http://www.iah.org/News/2002/021.html
IGWCO	Integrated Global Water Cycle Observation	http://ceos.esa.int/igosp9/docs/doc10_watertheme.doc (also see http://www.igospartners.org)
IHD	International Hydrological Decade 1965-1974	
IHP	International Hydrological Programme (UNESCO)	http://www.unesco.org/water/ihp/
ILEC	International Lake Environment Committee	http://www.ilec.or.jp/
IOC	Intergovernmental Oceanographic Commission	http://ioc.unesco.org/iocweb/
ISLSCP	International Satellite Land Surface Climatology Project	http://www.gewex.org/islscp.html
IWRM	Integrated Water Resources Management	
LBA	Large-scale Biosphere-Atmosphere Experiment in Amazonia	http://lba.cptec.inpe.br/lba
MAGS	Mackenzie GEWEX Study	http://www.usask.ca/geography/MAGS/
MED-HYCOS	Mediterranean HYCOS	http://medhycos.mpl.ird.fr/indexEN.html
MLIT	Ministry of Land, Infrastructure and Transport	http://www.mlit.go.jp/english/
MOPEX	Model Parameter Estimation Experiment	http://www.nws.noaa.gov/oh/mopex/
MSC	Meteorological Service of Canada	http://www.msc-smc.ec.gc.ca/
NE-FRIEND	Northern European FRIEND	http://www.nwl.ac.uk/ih/www/research/bfneuropean.html
NHS	National Hydrological Service	List available at http://www.wmo.ch/web/homs/links/linksnhs.html
NMS	National Meteorological Service	Various lists available, e.g. http://www.wmo.ch/web/homs/links/linksnhs.html http://www.wmo.ch/web-en/member.html#list http://badc.nerc.ac.uk/community/highlighted_sites/nat_met_offices.html http://www.knmi.nl/voorst/verken/english/nmi_e.html http://weather.bg/en/inst.html
NOAA	National Oceanic and Atmospheric Administration	http://www.noaa.gov/
NWIS	National Water Information System of USGS	http://water.usgs.gov/nwis
NWP	Numerical Weather Prediction	
NWRI	National Water Research Institute	http://www.nwri.ca/nwri.html

* until April 1998: International Council of Scientific Unions

OHP	Operational Hydrological Programme (WMO)	http://www.wmo.ch/web/homs/
PT	plausibility tool	
QA/QC	quality assurance/quality control	
SAWINET	Southern African Water Information Network	http://www.shared.de/gwp/sadc.htm
SC	Steering Committee	
SCWR	Subcommittee on Water Resources	http://ceb.unsystem.org/Former.ACC/accswr.htm
SHI	State Hydrological Institute	
SSG	Scientific Steering Group	
UN	United Nations	http://www.un.org/ , http://www.unsystem.org/
UNEP	United Nations Environment Programme	http://www.unep.org/
UNESCO	United Nations Educational, Scientific and Cultural Organization	http://www.unesco.org/ , http://www.unesco.org/water
UNH	University of New Hampshire Institute for the Study of Earth, Oceans, and Space Complex Systems Research Center Water Systems Analysis Group	http://www.unh.edu/ http://www.eos.sr.unh.edu/ http://www.csrc.sr.unh.edu/ http://www.watsys.unh.edu/
USGS	U. S. Geological Survey	http://www.usgs.gov/ http://water.usgs.gov/waterwatch/
WaterGAP	Water–Global Assessment and Prognosis (name of a model)	http://www.usf.uni-kassel.de/usf/forschung/projekte/watergap.en.htm
WBGU	Wissenschaftlicher Beirat der Bundes- regierung Globale Umweltveränderungen (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.ch/web/wcrp/wcrp-home.html
WHO	World Health Organization	http://www.who.int/en/
WHYCOS	World Hydrological Cycle Observing System	http://www.wmo.ch/web/homs/projects/whycos.html
WMO	World Meteorological Organization	http://www.wmo.ch/index-en.html
WWAP	World Water Assessment Programme	http://www.unesco.org/water/wwap/
WWDR	World Water Development Report	http://www.unesco.org/water/wwap/

Annex 39

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 / G.C. Wollenweber. (Including an English abstract: Documentation of existing algorithms for transformation of runoff data to grid cells) (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** (November 1994) Hydrological Regimes of the Largest Rivers in the World - A Compilation of the GRDC Database. (275 pp)
- Report No. 6** (December 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** (August 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** (February 1997) GRDC Status Report 1996. (25 pp, annex 36 pp)
- Report No. 14** (February 1997) The Use of GRDC - Information. Review of Data Use 1993/1994. Status: January 1997. (18 pp, annex 34 pp)
- Report No. 15** (June 1997) Third Interim Report on the Arctic River Data Base (ARDB) for the Arctic Climate System Study (ACSYS): Plausibility Control and Data Corrections (Technical Report). (3 pp, annex 20 pp)

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- Report No. 16** (August 1997) The GRDC Database. Concept and Implementation / J. Pauler, Th. de Couet. (38 pp, annex 4 pp)
- Report No. 17** (Sept. 1997) Report on the Third Meeting of the GRDC Steering Committee, Koblenz, Germany, June 25-27, 1997. (30 pp, annex 137)
- Report No. 18** (July 1998) GRDC Status Report 1997. (13 pp, annex 37 pp)
- Report No. 19** (August 1998) Evaluation of Statistical Properties of Discharge Data of Stations Discharging Into the Oceans - Europe and Selected World-Wide Stations / F. Portmann. (80 pp)
- Report No. 20** (July 1998) Water Resources Development and the Availability of Discharge Data in WMO Region II (Asia) and V (South-West Pacific) / W. Grabs, J. Pauler, Th. de Couet. (51 pp, annex 68 pp)
- Report No. 21** (Sept. 1998) Analysis of Long Runoff Series of Selected Rivers of the Asia-Pacific Region in Relation with Climate Change and El Niño Effects / D. Cluis. (23 pp, annex 58 pp)
- Report No. 22** (Oct 1999) Global Composite Runoff Fields on Observed River Discharge and Simulated Water Balances / B.M. Fekete, Ch.J.Vörösmarty, W. Grabs. – 2nd edition. (36 pp, annex 77 pp) 
- Report No. 23** (Oct 1999) Report of the Fourth Meeting of the GRDC Steering Committee, Koblenz, Germany, 23-25 June 1999. (29 pp, annex 140 pp)
- Report No. 24** (Nov 1999) Use of GRDC Data 1993 – 1999 : A Comprehensive Summary
- Report No. 25** (June 2000) GIS-related Monthly Balance of Water Availability and Demand in Large River Basins - Case Study for the River Danube / I. Dornblut. (27 pp, annex 46 pp) 
- Report No. 26** (Nov 2000) Modelling raster-based monthly water balance components for Europe / C.Ulmen (133 pp) 
- Report No. 27** (Jul 2002) Water Resources Management: Country Profile Germany. A contribution to the Global Water Information Network WWW.GLOBWINET.ORG / R. Winnegge, Th. Maurer (32 pp) 

 also available from GRDC-Homepage as PDF-file