Report 36

GRDC Report Series

The Global Terrestrial Network for River Discharge (GTN-R) : Real-time Access to River Discharge Data on a Global Scale

1st Interim Report

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

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About the Global Runoff Data Centre (GRDC):

The GRDC is acting under the auspices of the World Meteorological Organization (WMO) and is supported by WMO Resolutions 21 (Cg XII, 1995) and 25 (Cg XIII, 1999). Its primary task is to maintain, extend and promote a global database on river discharge aimed at supporting international organisations and programmes by serving essential data and products to the international hydrologic and climate research and assessment community in their endeavour to better understand the earth system. The GRDC was established at the Federal Institute of Hydrology in 1988. The National Hydrological and Meteorological Services of the 187 member states of WMO are the principal data providers for GRDC.

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Abbreviations used in this document:

BfG	Bundesanstalt für Gewässerkunde (German Federal Institute of Hydrology)
EFAS	European Flood Alert System
ETN-R	European Terrestrial Network for River Discharge
EC-JRC	EU-Joint Research Centre
ECV	Essential Climate Variable
GCOS	Global Climate Observing System
GCOS-IP	Implementation Plan for the Global Observing System for Climate
GEOSS	Global Earth Observation System of Systems
GTN-H	Global Terrestrial Network Hydrology
GTN-R	Global Terrestrial Network for River Discharge
GTOS	Global Terrestrial Observing System
GRDC	Global Runoff Data Centre
HWRP	Hydrology and Water Resources Programme of WMO
NHS	National Hydrologic Service
NRT	Near real-time
POC	Point of Contact
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

1. Introduction

River discharge has a role in driving the climate system, as the freshwater inflow to the oceans may influence thermohaline circulations. The statistical properties of river discharge are an indicator for climatic change and variability as they reflect changes in precipitation and evapotranspiration. They are also required for the calibration of global models, trend analysis and socio-economic investigations. Monthly observations of river discharge are generally sufficient, though daily data are needed to calculate the statistical parameters of river discharge. Most countries monitor river discharge, yet many are reluctant to release their data, in spite of WMO resolutions requesting free and unrestricted exchange. Additional difficulties arise because data are organised in a scattered and fragmented way, i.e., data are managed at sub-national levels, in different sectors, and using different archival systems. *(GCOS 2004)*

The Global Runoff Data Centre (GRDC) is the digital world-wide repository of river discharge data and associated metadata, mandated by the World Meteorological Organization (WMO). Its overall objective is to serve – on a long term basis – as a facilitator between providers and users of river discharge data in support of the water and climate related programmes and projects of the United Nations (UN), their specialised agencies and the scientific research community. For almost 20 years GRDC has been operating a database of historic discharge data.

Although many countries publish water level or river discharge data in the Internet, it still remains a tedious task to draw together all information needed for global assessments and models. From a global perspective the diversity of data sources is quite heterogeneous. Here GRDC is developing an additional service: The Global Terrestrial Network for River Discharge (GTN-R).

The project, started in spring 2005, and is divided into two phases. Phase 1 (2005-2006) comprises the designation of the baseline network of reference stations. Phase 2 (2007-2009) aims for the regular provision of discharge data to the GRDC with a maximum one-year delay and the establishment of a system automatically collecting river discharge data in near real time.

This report documents the status of the project at the end of the first project phase.

2. Project outline

2.1 Background

The Global Terrestrial Network for River Discharge (GTN-R) is an initiative of the GRDC, aiming at improving access to near real-time river discharge data for about 400 selected gauging stations around the world that capturethe majority of the freshwater flux into the oceans. GTN-R is also a GRDC contribution to the Implementation Plan for the Global Observing System for Climate and to the Global Terrestrial Network for Hydrology (GTN-H).

GTN-H is a joint effort of the Hydrology and Water Resources Programme (HWRP) of WMO, the Global Climate Observing System (GCOS) and the Global Terrestrial Observing System (GTOS) to establish a global hydrological "*network of networks*" for around 10 Essential Climate Variables (ECVs) that is building on existing initiatives and data centres and producing value-added products through enhanced communications, and shared development (*Figure 1*).

Since GCOS is one of the organisations participating in the establishment of the Global Earth Observation System of Systems (GEOSS) and the GCOS-IP is representing the climate component of GEOSS, GRDC and the GTN-R are closely linked to GEOSS.

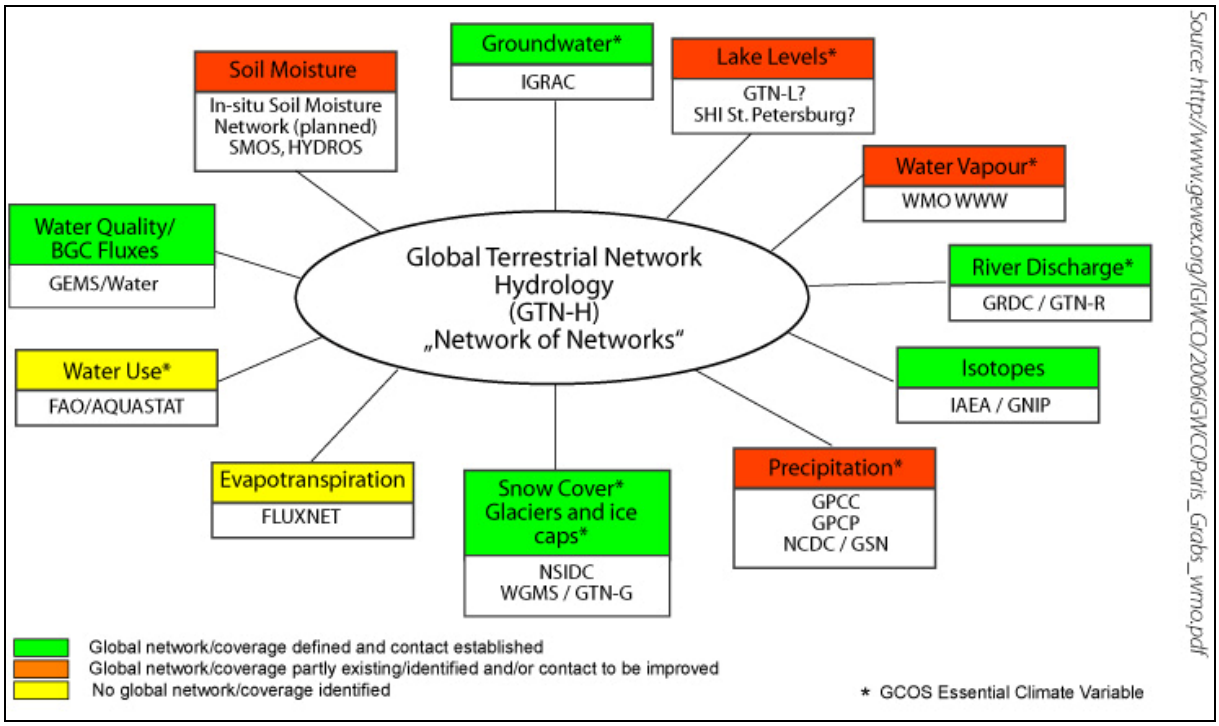

Figure 1: GTN-H is a global hydrologic "network of networks" ***(Status: July 2005)***

2.2 Concept

Today, many countries operate national real-time water level or river discharge transmission schemes. Increasingly, countries also publish this data online, typically through the web sites of their National Hydrologic Services (NHS) or similar official authorities. From a global perspective the diversity of data sources is quite heterogeneous (*Figure 2*).

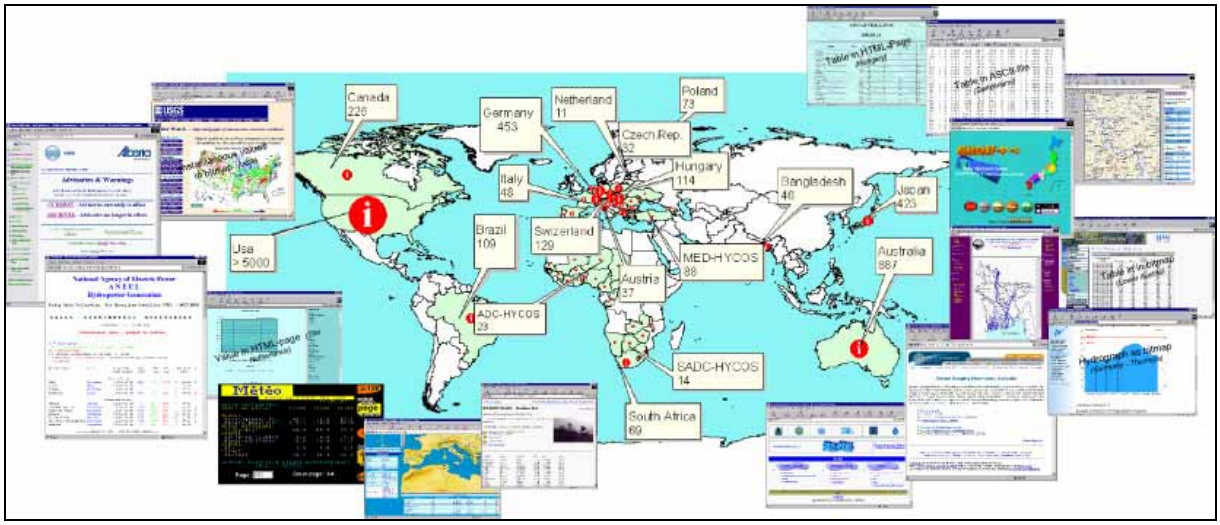

Figure 2: Online data availability and heterogeneity ***(Status: November 2001)***

At present the NHS of approximately 100 member states of the WMO maintain homepages on which they present their tasks and services. About 90 institutions make real-time data of water level and river discharge available on their web pages to the public. Some more publish information about the station networks and the gauging stations.

The basic idea of GTN-R is to draw together the already available information and real-time discharge data provided by the individual NHS and to redistribute it in a harmonised way to improve the access to near real-time river discharge data (*Figure 3*.

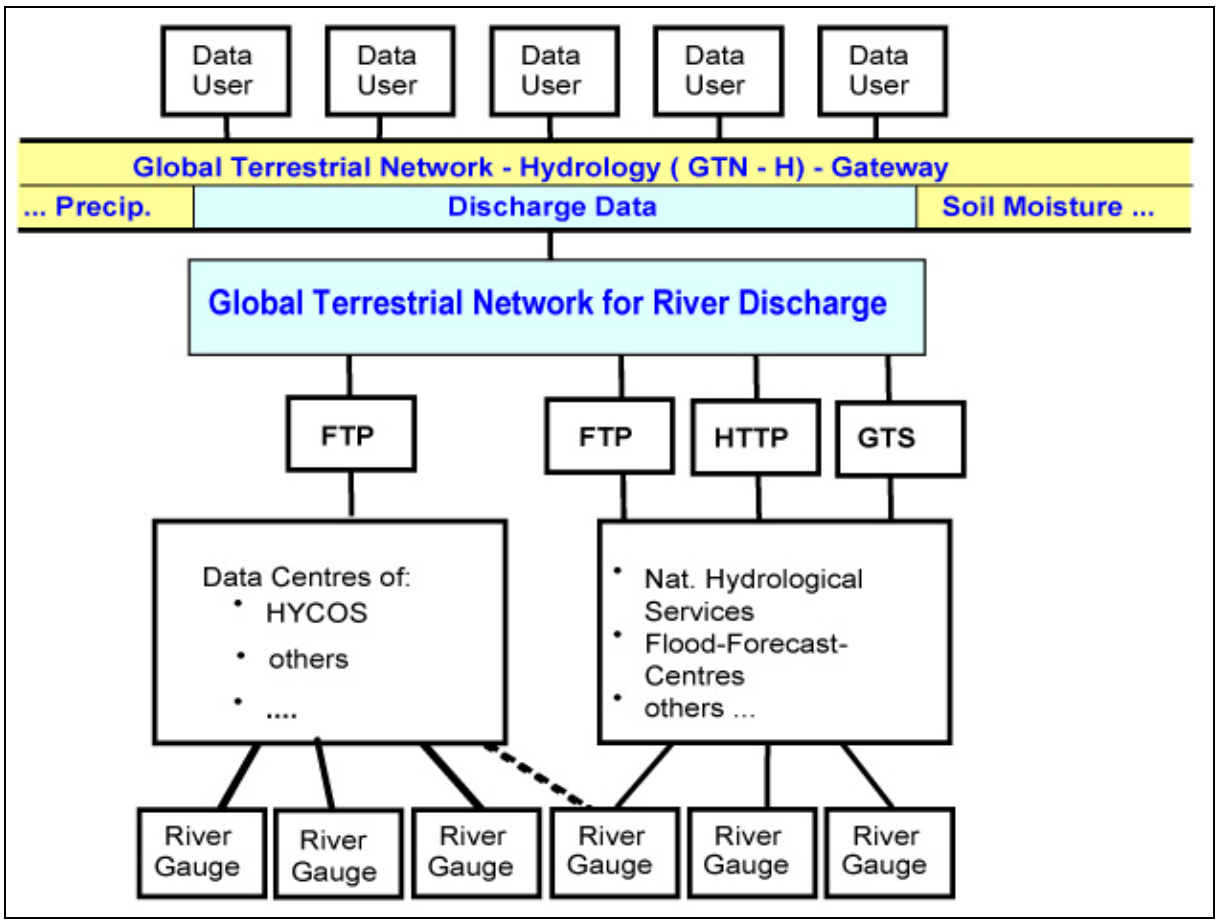

Figure 3: Technical structure of the GTN-R

The core of the GTN-R will be a software that allows to collect real-time water level and discharge data provided by individual NHS via Internet protocols (HTTP or FTP) in a variety of formats, to harmonise the heterogeneous data, and to redistribute it to customers in a standardised format.

2.3 Scope and schedule

In June 2000 an expert meeting in Geisenheim, Germany, proposed to establish a Global Hydrologic Observation Network for Climate to meet the needs for global hydrologic observations for climate. "This network should build upon existing hydrology networks and data centres, hence serving as the hydrologic complement of existing global terrestrial networks". (*GCOS 2000*)

One year later, in June 2001, the Global Terrestrial Network - Hydrology (GTN-H) was established. The goal of this "network of networks" is to present a set of essential climate variables (ECV) in near real-time on a global scale (Fig.1). The Global Runoff Data Centre contributes the river discharge component to GTN-H by provision of the Global Terrestrial Network for River Discharge (GTN-R).

The GTN-R has been defined as the GCOS Baseline River Discharge Network and is formally supported by action item T4 of the *Implementation Plan for the Global Observing System for Climate* (GCOS-IP) in support of the United Nations Framework Convention on Climate Change (UNFCCC), published by GCOS in October 2004 and appreciated and encouraged by UNFCC Decision 5/CP10 in

December 2004. The action item T4 of the GCOS-IP calls upon the parties of the UNFCCC to timely contribute regular updates to the GRDC with a maximum one-year time lag by 2009.

A phased implementation of the GTN-R is recommended in the GCOS-IP to ensure global monitoring of river discharge:

- In project phase 1 (2004-2006)

  a network of reference stations has to be designated. Based on past demands for data, the GRDC has identified 380 stations near the downstream end of the largest rivers of the world – as ranked by their long-term average annual volume. These stations would collectively form a new GCOS baseline network. Data from these stations will capture about 70% of the global freshwater flux to the oceans. All stations must have been observed in the past and be operational until today, ideally equipped with automated recording and transmission schemes. This network of reference stations had to be finalised by 2006. Each station being part of the GTN-R is represented by a set of basic metadata including the location and contact information.

- In project phase 2 (2007-2009)

  the regular provision of daily discharge data within one year of their observation has to be established until 2009. Using the proven transfer ways, usually via GRDC, the historic time series of daily discharge at the selected stations are collected firstly. In a further step the reporting of stations with near real-time data transmission will be established by the configuration of appropriate transfer schemes most suitable for the providing institutions. Preferably, this should be done via an FTP or HTTP address.

GRDC is developing a software system for the automated data collection capable to “harvest” the water level and discharge data provided by the individual NHS via Internet protocols (HTTP or FTP) in time steps of at least 1 hour and to harmonise the variety of formats. Harmonised data sets will be made available by GRDC then in a standard format for further use by the hydrologic and climate research community.

The GCOS-IP demands from the GTN-R, in co-operation with WMO-CHy, to develop standards for the near real-time transmission of river discharge observations. Depending on the number of stations reporting annually to the GTN-R, the number of stations with real-time access to data and the number of countries submitting data GRDC timely, the rules established for the GTN-R could become standard for the data transfer between data providers like the different NHS and the data centres such as the GRDC.

The bottleneck in advancing integration initiatives such as the GTN-R always is capacity. Therefore it is especially good news that in December 2005 GRDC has been awarded a three-year contract to build up an automated near real-time data collection service for river gauging data by the EC-Joint Research Centre (JRC) as a contribution to the European Flood Alert System (EFAS). This contract provides a very welcome and urgently needed cross-sponsoring for also advancing the GTN-R, as many results will be readily re-useable for the GTN-R. For the envisaged synergy effects please read section 5.

3. Activities and results

3.1 Establishment of contacts to the National Hydrologic Services

In April 2005 the GCOS secretariat of WMO sent out a data request and support letter signed by the WMO Secretary General to The Permanent Representatives with WMO and their Hydrologic Adviser of 82 countries which feature tentative GTN-R stations. This letter asked for an "Institutionalised

regular provision of daily river discharge data for selected rivers and gauging stations of the GTN-R" and included a country-tailored information package. Except The Permanent Representative with WMO and their Hydrologic Advisers, the active contacts of the GRDC were asked to support the GTN-R. The Support Letter is available in 5 languages at http://gtn-r.bafg.de/servlet/is/9419/. In summary 169 persons or institutions in 82 countries were contacted. A detailed list of addressees is given in Annex I.

Results as of July 2007:

21 countries have replied positively on the request for collaboration and GRDC already received a number of datasets of both historic or NRT-data. As shown in *Table 1*, most of them replied within the first six months after sending out the support letter, some in the following year. The last reply dates to September 2006.

Country	Reply to	Responsible Party	First Reply	Last Reply
ALGERIA	WMO	ANRH - Ministère de l´Equipement et de l´Amenagement du Territoire, Department Hydrologie	24-May-05	24-May-05
BENIN	GRDC	Direction Generale de l'Hydraulique	09-Aug-05	09-Aug-05
CANADA	GRDC	Meteorological Service of Canada, Water Survey of Canada	27-May-05	24-Aug-05
CHINA	GRDC	Ministry of Water Resources, Bureau of Hydrology	06-Jun-05	06-Jun-05
COLOMBIA	WMO	Ministerio del Medio Ambiente, Instituto de Hidrologico, Meteorologica y Estudios Ambientales (IDEAM)	01-Jul-05	01-Jul-05
CONGO	WMO	Service Météorologique National du Congo	05-Jul-05	05-Jul-05
ECUADOR	GRDC	Instituto Nacional de Meteorología e Hidrología (INAMHI)	22-Sep-06	07-Nov-06
GERMANY	GRDC	Bundesanstalt für Gewässerkunde	07-Jul-05	07-Jul-05
ICELAND	GRDC	ORKUSTOFNUN, National Energy Authority	15-May-06	15-May-06
LATVIA	GRDC	Latvian Hydrometeorological Agency (LVGMA)	05-May-05	01-Nov-05
MOLDOVA	GRDC	State Hydrometeorological Service of Moldova (SHS)	01-Jul-05	01-Jul-05
MYANMAR	GRDC	Department of Meteorology and Hydrologgy, Hydrology Division	05-May-05	05-May-05
NETHERLANDS	GRDC	Rijksinstituut voor Kust en Zee, Monitoring Systeem Water (MSW)	03-May-05	02-Jun-05
NORWAY	WMO	Norwegian Water Resources and Energy Directorate (NVE)	02-Jun-05	08-Jan-07
PAPUA NEW GUINEA	GRDC	Office of Environment and Conservation, Water Resources Management Branch	13-Sep-05	13-Sep-05
PERU	WMO	Servicio Nacional de Meteorología e Hidrología (SENAMHI)	11-May-05	11-May-05
ROMANIA	WMO	National Institute for Hydrology and Water Management (INHGA)	15-Jun-05	04-Jan-07
SOUTH AFRICA	GRDC	Department of Water Affairs & Forestry (DWAF)	08-Jul-05	10-Aug-05
TURKEY	GRDC	Directory of State Hydraulic Works (DSI)	18-Aug-05	25-Aug-05
UNITED KINGDOM	GRDC	National Water Flow Archive (NRFA)	07-Jul-05	07-Jul-05
UNITED STATES	GRDC	USGS, Office of Surface Water	31-May-05	06-Jun-05

Table 1: Reply to the invitation letter of the WMO Secretary General and the GCOS Secretariat

In summary, 75% of the contacted national authorities made no reply. Unfortunately this also includes countries whose NHS provide their data already online in the Internet or still provide GRDC with updates in the past. In the cases of a positive reply, mostly a general interest was shown, but detailed discussions how to contribute have not taken place. In a few cases, the support is still unclear. In some cases metadata were provided. Only 10 NHS provided GRDC with historic records of discharge data. The NHS of only three countries, INHGA of Romania, NVE of Norway and ORKUSTOFNUN of Iceland, provide the GRDC with daily discharge data in near real-time.

3.2 Designation of the network of reference stations

Enclosed to the GTN-R invitation letter an information package was sent which included a first selection of reference stations proposed by the GRDC and based on its data holdings at that time. Representing the major rivers of a country by its most downstream GRDC-station, the total of 380 stations along the coastlines captures the majority of global freshwater fluxes into the oceans.

The national data providers were invited to evaluate the initial station selection regarding its suitability to capture the freshwater fluxes to the oceans in terms of continuity, length and quality of the historic records. They were requested to confirm the location of the stations, define their operational status including the measurement, data recording and transmission technologies used, and provide GRDC with the updated station metadata.

All stations should have been observed in the past and be operational until today, ideally be equipped with automated recording and transmission schemes. Each station being part of the GTN-R should be represented by a set of basic metadata including the location and contact information. The NHS were invited to modify GRDC's initial selection according to their knowledge of the local conditions.

Results as of July 2007:

On recommendation of the replying NHS, in total 185 stations were confirmed as reference stations until July 2007 (Annex II):

- 97 stations of the initial selection were confirmed by the NHS,
- 88 stations were newly added by the NHS to the selection,
- 52 stations were cancelled or substituted by another station at the same river,

For 265 stations from GRDC's initial proposal , no feedback was received; the status of these stations still has to be clarified (Annex III).

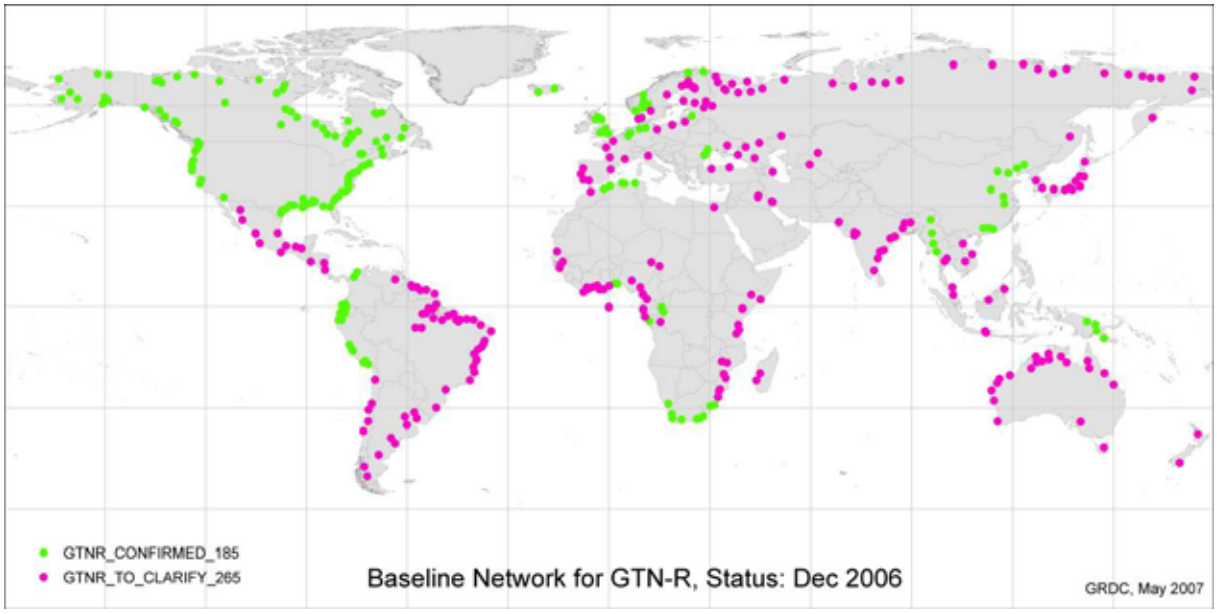

Figure 4: Status of confirmation of the GTN–R network (Status: July 2007)

Figure 4 illustrates the status of confirmation. The baseline network for the GTN-R currently constitutes a total of 450 discharge stations (185 confirmed stations and 265 stations to clarify).*Figure 5* shows the network of stations along with their catchment areas.

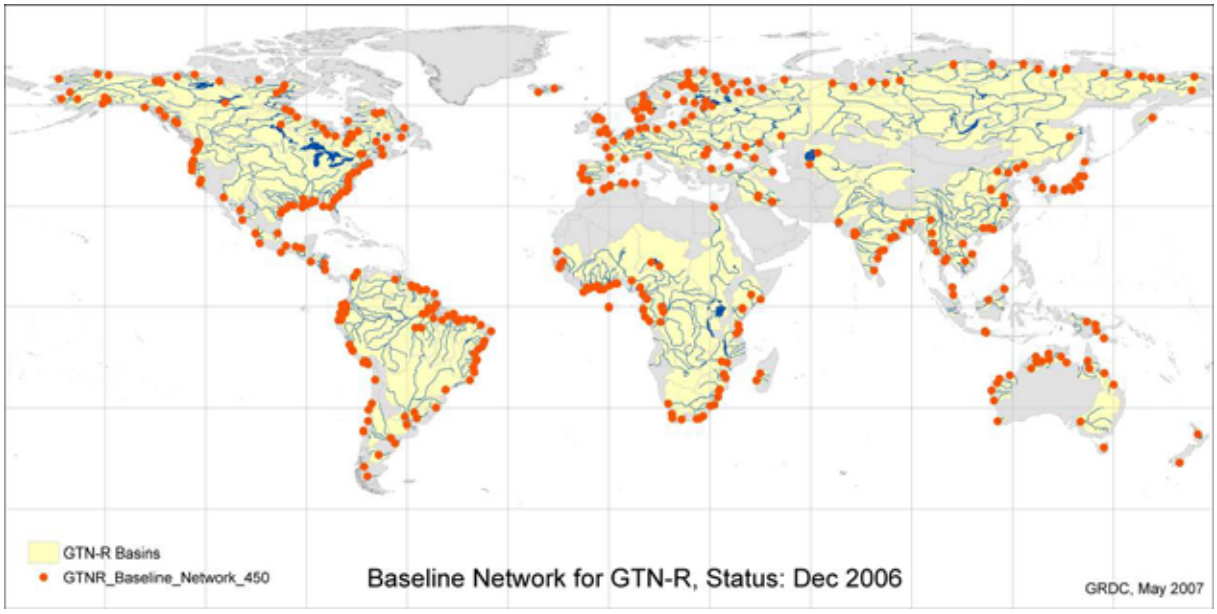

Figure 5: The GTN–R network of 450 river gauges scheduled to deliver near real-time discharge data along with their catchment areas (revised selection)

Because of the low percentage of replies (25%), the baseline network of reference stations on a global scale was not finalised on time.

3.3 Collection of historic records of daily discharge data

Within GTN-R the historic time series of all confirmed reference stations are needed to check the plausibility of the near real-time data and to set the near real-time data into perspective. The time series need to go back as long as possible since they will be of higher value for the quality checks if they provide as much historic coverage as possible. In case of newly established stations, the nomination of corresponding or succeeding station/s with longer time series would be helpful.

. With the invitation letter of April 2005 the national data providers were called upon to provide the GRDC with the historic records of river discharge at the confirmed stations and to ensure a regular delivery of daily discharge data within one year of their observation. The historic records will be collected offline. As shown in *Table 2*, 10 of the responding countries provided the GRDC with time series of river discharge for the confirmed stations, among them for the first time since the existence of the GRDC discharge data from China.

Country	Received Data	Kind of data	Temporal Resolution	Provider Institution
BENIN	river discharge	historical	daily	Direction de l'Hydraulique
CHINA	river discharge	historical	daily	Bureau of Hydrology, Ministry of Water Resources
ECUADOR	river discharge	historical	daily	Instituto Nacional de Meteorología e Hidrología (INAMHI)
GERMANY	river discharge	historical	daily	Bundesanstalt für Gewässerkunde Koblenz (BfG)
LATVIA	river discharge	historical	daily	Latvian Hydrometeorological Agency (LVGMA)
MOLDOVA	river discharge	historical	monthly	State Hydrometeorological Service of Moldova (SHS)

NETHERLANDS	river discharge	historical	daily	Rijksinstituut voor Kust en Zee, Monitoring Systeem Water (MSW)
NORWAY	river discharge	historical	daily	Norwegian Water Resources and Energy Directorate (NVE)
ROMANIA	river discharge	historical	monthly	National Institute for Hydrology and Water Management (INHGA)
SOUTH AFRICA	river discharge	historical	daily	Department of Water Affairs & Forestry (DWAF)
UNITED KINGDOM	river discharge	historical	daily	Centre for Ecology and Hydrology (CEH)
UNITED STATES	river discharge	historical	daily	US Geological Survey

Table 2: Provided historic records of discharge data by country (July 2007)

Considering that currently only Slovenia, Norway and the Netherlands deliver historic data to the GRDC regularly and un-requested, it is of high importance to keep the GTN-R in the responsible NHS's mind.

For the United States, Canada, the United Kingdom and South Africa, the historic time series are available in the Internet for download. There are some other countries, e.g. France, whose hydrological data are provided by the NHS to the public in the Internet. Because these data often are provided in very detailed websites, the download is laborious and inefficient. Further negotiations are needed to simplify the transfer procedures in co-operation with the providing institutions.

3.4 Regular provision of daily discharge data in near real-time (NRT)

Discharge data in near real-time will be needed from those stations that already have an automated data transmission and that measure either discharge directly or that calculate discharge from measured water level via a stage-discharge relation (curve, table, function, etc.). In most countries, the national or regional Hydrologic Services operate their river gauging stations already in automated real-time mode, i.e. that they continuously receive current water level or river discharge data from their gauging stations. The GTN-R does not primarily seek access to the gauging stations themselves, but rather prefers to be provided by the services that collect these data centrally (e.g. at an FTP server of the NHS). The NHS of 10 contributing countries are able to provide discharge data in near real-time (daily mean) of totally 130 relevant GTN-R stations, for 7 of the contributing countries currently no real-time discharge data are available (*Table 3*).

Country	Near real-time data available for ... relevant stations
CANADA	39
COLOMBIA	2
CONGO (Republic Congo)	3
GERMANY	3
ICELAND	2
NETHERLANDS	1
NORWAY	8
PERU	7

Country	Near real-time data available for ... relevant stations
ROMANIA	1
SOUTH AFRICA	9
UNITED KINGDOM	6
UNITED STATES	54

Table 3: Number of relevant stations with near real-time discharge data by country (July 2007)

Since July 2007 the NVE from Norway and INHGA from Romania already provide the GRDC with the daily mean of river discharge once a day with a one-day delay via FTP. The ORKUSTOFNUN of Iceland provides GRDC with access to its hydrologic database to download the data continuously via HTTP. To make the provision of near real-time data as easy as possible, the GRDC has developed a special data file format for the exchange of real-time data and a corresponding naming convention. (*Table 4*)

Country	Received Data	Kind of data	Temporal Resolution	Number of Stations	Provider Institution
ICELAND	river discharge	actual day	daily	3	ORKUSTOFNUN National Energy Authority
NORWAY	river discharge	actual day	daily	8	Norwegian Water Resources and Energy Directorate (NVE)
ROMANIA	river discharge	actual day	daily	1	National Institute for Hydrology and Water Management (INHGA)

Table 4: Provided near real-time discharge data by country (July 2007)

3.5 Collection of metadata

Metadata, commonly defined as "data about data", are needed in the GTN-R as a background to locate the stations, to select relevant stations, to obtain the NRT data, and to put the instantaneous values into perspective. For each selected river gauging station that is part of the GTN-R, the basic metadata of the gauging station, describing its characteristics, are required. To establish and maintain an automated electronic data transfer, not only the station metadata are important, but also information about the data provider and the data transfer facilities. The supplementary information (metadata) as requested in the Information Package of April 2005 is listed in Annex V.

As illustrated in *Table 5*, the NHS of 11 countries provided station metadata . The quality of the metadata varies from basic (river and station name, coordinates, contact details) to detailed, but divers, description of the gauging station and the observing and transmission schemes. A summary table of the metadata of the 185 confirmed GTN-R stations as provided up to now is given at the GTN-R homepage (http://grdc.bafg.de/servlet/is/9465/).

Country	Received Data	Provider Institution
ALGERIA	metadata	Department Hydrologie

Country	Received Data	Provider Institution
CANADA	metadata	Meteorological Service of Canada, Water Survey of Canada
CONGO	metadata	Service Météorologique National
MYANMAR	metadata	Department of Meteorology and Hydrologgy, Hydrology Division
NETHERLANDS	metadata	Rijksinstituut voor Kust en Zee, Monitoring Systeem Water (RIKZ/MSW)
NORWAY	metadata	Norwegian Water and Energy Directorate (NVE)
PAPUA NEW GUINEA	metadata	Office of Environment and Conservation
PERU	metadata	Servicio Nacional de Meteorología e Hidrología (SENAMHI)
ROMANIA	metadata	National Institute for Hydrology and Water Management (INHGA)
UNITED KINGDOM	metadata	Centre for Ecology and Hydrology, National Water Archive (CEH)
UNITED STATES	metadata	USGS Office of Surface Water

Table 5: Provider of metadata by country (July 2007)

On the 2nd GTN-H panel meeting 2005 the development of a web-based, multilingual software product for the exploration of metadata was announced, provided that

- a metadata standard (WMO 19115 Core metadata standard)
- a standardised detailed metadata format (GRDC NRT format, version 3.0)
- an adequate software product (off-the-shelf or from a similar project, like ETN-R)
- funds to buy and adapt such a software product by an external company

are available. As reported on the WMO website, the Version 0.2 of the WMO Core Metadata Standard is available since September 2004. GRDC has defined the version 3.0 of its Near Real-Time Data Format in 2006. It is already in use in the GTN-R.

In 2005 it was intended to engage in the German NOKIS++ project. NOKIS++ is a project which investigates the implementation of information infrastructures as part of the Integrated Coastal Zone Management. In this framework the NOKIS Metadateneditor, Version. 2.0 was launched recently. Currently GRDC has no active part in the development and design of NOKIS++. In the framework of NOKIS a web-based environment allowing the standardised metadata collection, processing and management was developed by a German software company. Meanwhile this software is commercially distributed as a stand-alone product and is as such of high interest for GRDC's future metadata management.

Alternatively, the double use of the metadata management structures internally developed within the envisaged European Terrestrial Network for River Discharge (ETN-R) was intended. Unfortunately, over the course of the latter project the development of the metadata management system was excluded from the ETN-R. Consequently, no adequate software product for the gathering and management of hydrological metadata is internally re-usable.

3.6 Development of a software system for an automated data collection

GRDC is currently developing software providing a service capable to "harvest" real-time river discharge data automatically, using FTP and HTTP servers via Internet protocols. This software application will be able to store, harmonise, summarise discharge and water level data in near real-time and make the collected data available in a standard format. In 2004 GRDC developed a prototype of an operative engine that continuously monitors online active data sources according to their download frequency attributes, visits them, downloads the relevant data files and stores them in an interim database for harmonisation.

Based on the experiences gained with this prototype, GRDC started in 2006 within the ETN-R project to develop a software system that draws together the near real-time river water level and discharge data with time steps of at least 1 hour provided by individual NHS via Internet protocols.

This software system will be able: *(GRDC 2007c)*

- to process and store the data in a database,
- to check the plausibility of the data,
- to transform water level data into discharge data where required,
- to classify the data on the background of historic data, and
- to redistribute all required European data in a harmonised way via the Internet.

3.7 Map product on Real-Time Hydrological Conditions

As an application of the automatically collected and harmonised data, a mapping procedure is planned that graphically displays the stations of the GTN-R network in an interactively scaleable world map at a web page by means of an internet map server (IMS). Absolute discharge values as well as classified percentiles relative to the long-term characteristics of the stations should be displayed as attributes.

In 2005 the ArcIMS seemed to be the appropriate solution for delivering dynamic maps and services via the Internet, the more so as it was generally used in the Federal Institute of Hydrology (BfG), GRDC's hosting institution. Since that time a prototype of a scaleable and interactive map is provided at http://gtn-r.bafg.de. Using the ArcReader software the maps display the stations of the initially proposed GTN-R network (interactive zooming, viewing of labelled stations and basins at smaller scales, selection of various information layers)). Apart from this prototype no further activities regarding a web mapping application were made.

3.8 GRDC Near Real-Time Data Format, Version 3.0

To make the provision of NRT data as easy as possible for all sides, the GRDC has developed an exchange format that can be interpreted without problems both by the responsible persons as well as by computers. A naming convention for exporting near real-time data was defined to prevent accidental data losses and dead locks and will also allow for simple versioning of the collected files. It has also to be taken into consideration that an import into current standard software packages should be as easy as possible. Within these constraints and in revision of the former versions of the GRDC Near Real-Time Data Format, Version 3.0 has been defined.

Real-time discharge data, as it will be transported by the GRDC data exchange file format, is nearly unstructured. In most observed cases it contains identifiers of the respective gauging stations, time and date of the measurement, water level, river discharge and a number of logical values (flags). The latter are responsible for annotating conditions which may lead to errors or non-plausible data. In general no station metadata (except the station identifier) will be transported during real-time discharge data exchange. A more detailed description of the data format is given inAnnex IV.

4. Synergies with the European Terrestrial Network for River Discharge (ETN-R)

4.1 Scope and Status of the ETN-R project

All European countries dispose of networks of river discharge gauging stations. Many of them operate their network already in automated real-time mode, i.e. their National Hydrological Services (NHS) continuously receive current water level or river discharge data for purposes of e.g. flood forecasting. Increasingly, some of the countries already publish some of this data online, typically on the web sites of their NHS. Nevertheless, from a European perspective the diversity of data sources, types and formats is considerable and quite heterogeneous. There is currently no operational system providing the service of one-stop-shopping of near real-time river discharge data. (*GRDC 2005*)

Therefore it is especially advantageous that in December 2005 GRDC has been awarded a three-year contract to build up an automated near real-time data collection service for river gauging data by the EC-Joint Research Centre (EC-JRC) as a contribution to the European Flood Alert System (EFAS). This project provides very welcome and urgently needed cross-sponsoring to push the GTN-R, as many results of the project will be re-useable.

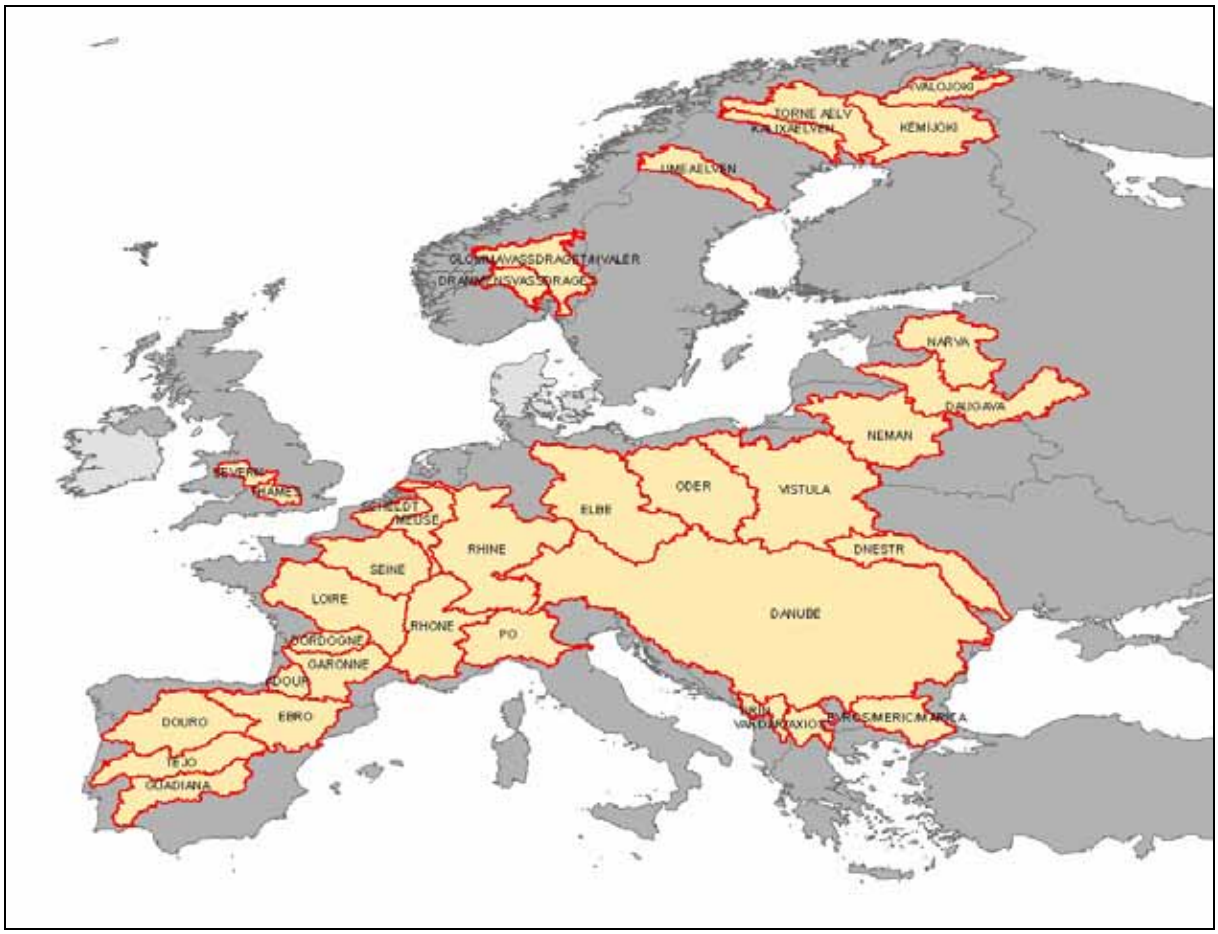

Figure 6: River basins relevant for the ETN-R ***(Source: GRDC, 2007b)***

EFAS produces twice daily a 10-day early flood forecast for entire Europe on an research basis. In order to improve the forecast's quality, the European Terrestrial Network for River Discharge (ETN-R) was initiated to facilitate the access to river discharge and water level data which are collected and maintained on national and/or regional scale. The data needed for EFAS and covered by ETN-R are river discharge and water level data in near real-time with a high temporal resolution. In addition

historic data are needed as long time series to check the plausibility of the NRT data and to calibrate the EFAS model. Metadata about the providers, the data transfer and the gauging stations play an important background role for selecting the appropriate stations and for the data transfer. More detailed information about the project and the project progress is included on the ETN-R website (http://etn-r.bafg.de/).

During the project, the GRDC will develop a software system for the automated collection, quality control and distribution of the NRT data. This will include tests of real-time discharge data delivery, the development of a plausibility check functionality and the development of a mapping application that allows for the display of the current discharge situation on a European map. The project will require the cooperation of water authorities from 36 European countries and thus a considerable part of the project will consist of networking, including negotiations with country representatives. To get access to the river gauging data for the river basins covered by ETN-R (*Figure 6*, a total number of 71 institutions were contacted between January and November 2006.

A large majority of the data owners have agreed to support the ETN-R project and EFAS by providing their metadata and actual data in near real-time (Annex VI and Annex VII). So far 85% of the contacted institutions replied positively on the invitation to contribute to the ETN-R. Approx. 67% of them provided station metadata, 10% already finalised the station selection and 5 NHS provide the EC-JRC via the GRDC with discharge data in near real-time online. *Figure 7* shows the status quo of the contributions to ETN-R by country.

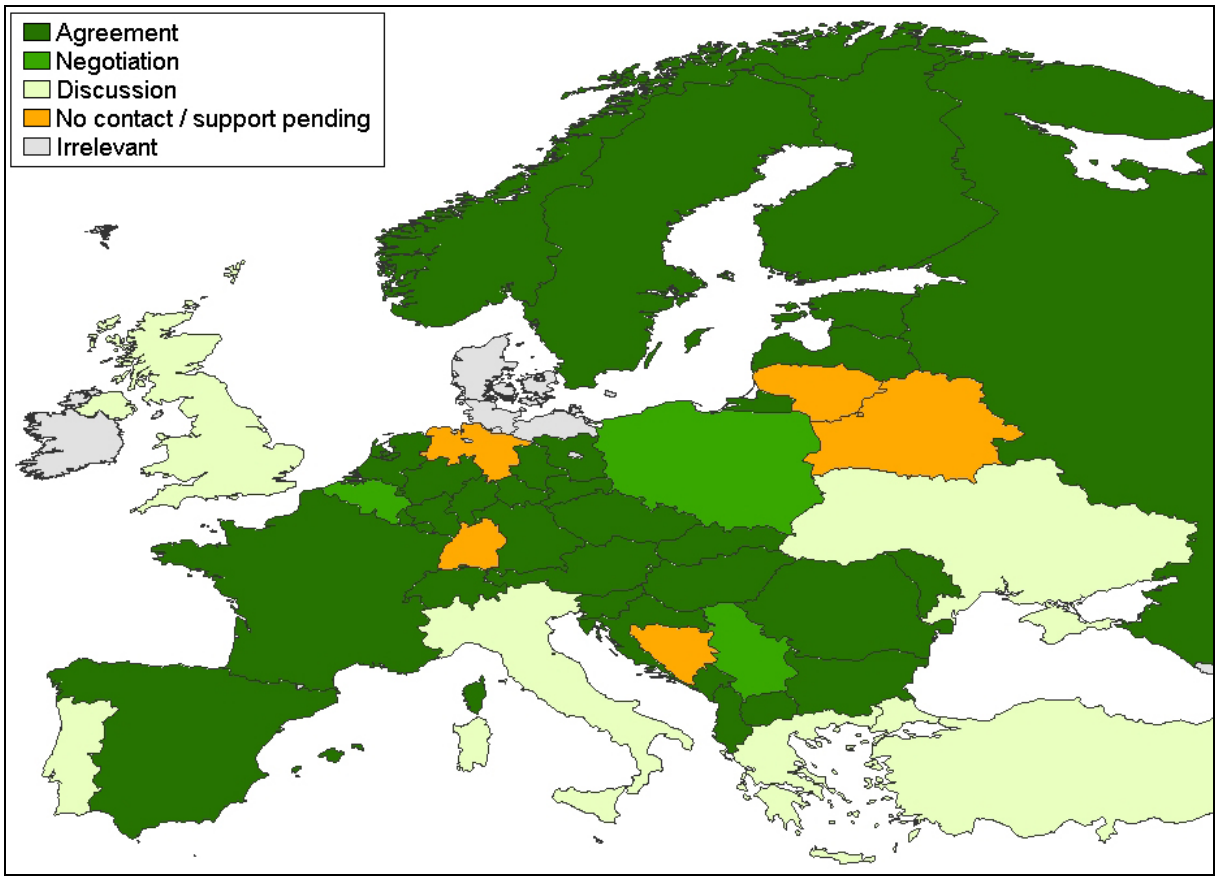

Figure 7: Project Status of the ETN-R ***(Source: GRDC internal ETN-R Report)***

For the ETN-R software, which will collect, harmonise and redistribute the near real-time data, task analysis and system design are completed and the system development is well in line with the overall project plan.

The currently designed ETN-R system consists of four core sub-systems and a management client:

1. Data storage

   allows for saving collected near real-time data, historic discharge data and metadata within a relational database management system.

2. Data collection and processing

   allows for collecting near real-time data in various formats from different data providers. It also supports a number of network protocols. Furthermore it enables automated plausibility checks on the collected data and harmonises it with respect to units of measurement and data formats.

3. Data dissemination

   allows for the export of collected near real-time data in a harmonised export format. It also supports the transfer to the Joint Research Centre by means of the file transfer protocol (FTP).

4. Scheduler

   provides timer-controlled execution of data collection and data dissemination. It is also providing functionality for creating workflow-based processes.

In addition to these core sub-systems it is intended to create applications that operate on top of the core sub-systems. One application that is to be built at a later stage of the project will be a mapping application, which will allow for the display of the current discharge situation on a European map (*GRDC 2007c*).

The first prototype is operational since April 2007. Data providers are requested to automatically upload the daily mean discharge of their gauging stations to an agreed FTP site, preferably once a day. Alternatively, data could be provided via an HTTP address or via e-mail. The regular automated transfer of near real-time data has started with the first providers in spring 2007. The ETN-R Management Client was installed for testing at the EC-JRC in Ispra in June 2007. A detailed description of the software system is provided in *GRDC 2007c* (available at the ETN-R website (http://etn-r.bafg.de).

4.2 Expected synergy effects

Synergies between both projects are evident, but however limited due to the different focus. Only 18 of the 36 countries contacted within the ETN-R project are of interest to the GTN-R, since GTN-R focuses on the outlet stations, while ETN-R focuses on the complete river basins and therefore also covers the inland countries, which are of no interest for GTN-R. *Figure 8* shows the river basins covered by both the GTN-R (red outlined) and the ETN-R (blue coloured).

In case of changed administrative structures or moved responsibilities, particularly the provider information enables the GRDC to refresh the contacts and/or establish new ones. For 10 countries contacts were established successfully within the ETN-R and are suitable for the GTN-R. (Annex VIII). Presumed that the station selection for the GTN-R constitutes a subset of the ETN-R station selection, an application of the ETN-R data for the GTN-R seems practicable. However, this will only be feasible if the data owners agree to this additional usage of their data.

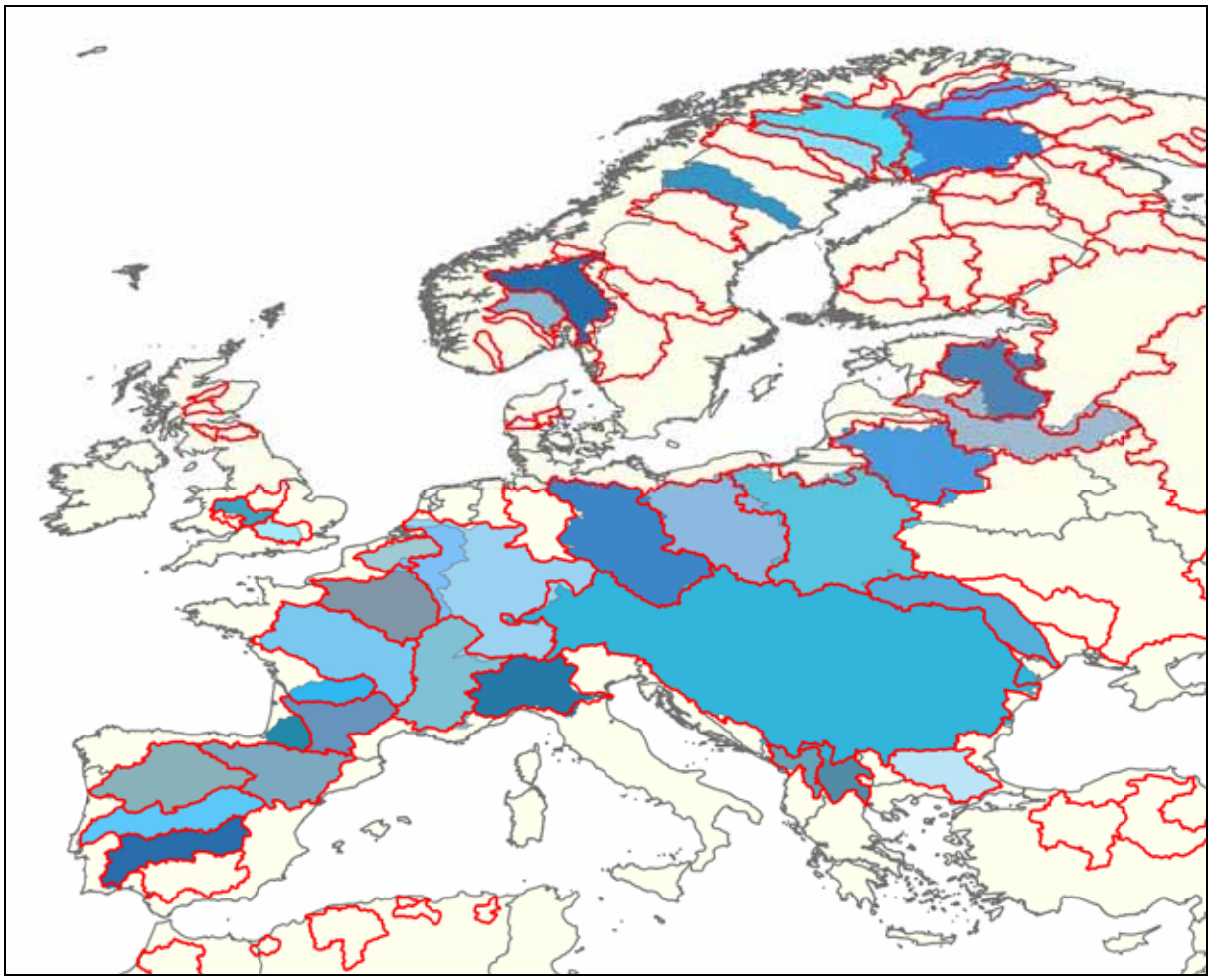

Figure 8: Basins of the GTN-R (red-outlined) and ETN-R (blue coloured) (Source: GRDC internal ETN-R Report)

The metadata collection of the ETN-R provides a valuable basis for the revision and extension of the initially proposed selection of GTN-R reference stations. Annex IX lists the metadata required for the ETN-R. Based on the feedback that the providers have given in the ETN-R project about the suitability of their stations for NRT data transfer, a corresponding revision of some of the GTN-R European river basins seems appropriate. This is the case for Sweden, where the non-ETN-R basins should be eliminated from the GTN-R basin selection since these basins are strongly influenced by hydropower and NRT data is not easily available.

The software system which will be developed within the ETN-R project, will be used also for the automated data transfer of real-time data, the harmonisation and processing of the incoming data. The version 3.0 of the GRDC NRT data format is already in use within GTN-R. Like for the data harvesting software, the re-use of the ETN-R schemes is intended for the development of the mapping application, the GRDC NRT Monitor.

5. Next projects steps

5.1 Evaluation of contacts to the National Hydrological Services (NHS)

As described above (section 3.1.), 75% of the contacted national authorities made no reply. The reasons for this are manifold in the organisational and administrative or the technical dimension. In some countries the administrative structures changed or the responsibilities moved from the governmental to regional levels. Sometimes the representatives, advisors and persons of contact known to the GRDC have retired or resigned from their office. In all these cases the invitation to contribute to the GTN-R did not find attentive ears. Today, more than two years after sending the invitation letter, realistically no further positive replies for collaboration are to be expected. On the other hand no explicit denial was communicated. Thus, all present contact information of the non-responding countries has to been re-evaluated.

For the European countries, the successfully established contacts and implemented transfer schemes of the ETN-R are of high interest (Annex VII). Corresponding to the general agreement that the data collected in the scope of the ETN-R project will not be used for other purposes than the ones that the data owners explicitly agree to, the institutions contributing to the ETN-R shall be asked to release the station metadata as well as the near real-time data for the GTN-R project too. To avoid unnecessary repeating data requests, the respective institutions should not be contacted until the station selection for the ETN-R is final.

For the countries in the WMO regions 1–5 whose NHS did not reply so far, the contact information has to be updated. As proven within the ETN-R project, a general encouragement by supporting institutions and programmes addressed to the highest national water authorities is very helpful to get a wider acceptance of a project and to identify the responsible person or institution with their assistance. A data provider workshop, as organised by the GRDC and the EC-JRC within the ETN-R, to demonstrate the benefits of the project for and the expected contributions by the data provider promote the willingness to contribute.

The majority of the NHS maintain own websites. The WMO refers on their website to more than 80 National Hydrological and Hydro-Meteorological Services or to other national bodies in charge of operational hydrology and water-resources assessment activities. Here additional contact information may be found to synchronise and update the list of valid contacts.

Nevertheless, there will remain a number of countries where no contact can be established to their NHS. The reasons for this may vary from low budget situations and the missing technical equipment to administrative obstacles or a fundamental denial of the project. However, until now no fundamental denial was communicated in GTN-R.

5.2 Update of the baseline network of reference stations

Currently the baseline network consists of 450 gauging stations: 185 gauging stations in 20 countries are confirmed by the responsible NHS, 265 stations in 62 countries remained in the status of the initial proposal of April 2005. The suitability and the applicability of these stations for the GTN-R has to be clarified. The suitability of a proposed station to capture the freshwater flux into the oceans might be re-examined continually in terms of location, equipment and transfer, and of continuity and quality of the data records. Depending on the progress of the ETN-R, for Europe the final designation of the baseline network will be postponed until the station selection within the ETN-R is completed.

In parallel, the status of the remaining stations of the initial selection for all countries which are not covered by the ETN-R have to be clarified on the basis of detailed station and data transfer information.

The examination of publicly available inventories of hydrologic stations in the Internet might be helpful, but is only a first, small step. The final confirmation of the initial station selection depends on reliable station information. The station selection is of low value without the legal agreement of the potential providers of the hydrologic data. Consequently, stations that cannot be confirmed by its providers or where the providers cannot be convinced to support GTN-R have to be removed from the proposed reference network.

5.3 Establish a routine for the un-requested regular update of daily data

The continuous update of historic discharge data forms the core business of the GRDC, the - regular update of digital data is however a great challenge. The establishment of an institutionalised procedure for the regular and un-requested update by the providing institutions, usually the NHS, is one of the most important objectives of GRDC's work. Currently only few NHS send their discharge data un-requested to the GRDC regularly. The NHS of Slovenia, Norway and the Netherlands provide time series of discharge data annually when the quality checks are done. The majority of the NHS send their data only on repeated requests, mostly via e-mail or FTP. More and more NHS make their data public in the Internet, some of them for download.

The historic data will be collected offline for the first delivery. They can be provided before or after the start of the automated data transfer. The annual update of the discharge time series is requested at that time when the quality checks are done, ideally within one year of their observation. If daily data are not available, monthly river discharge (monthly mean) would be an alternative. The annual updates preferably should be provided online.

If desired by the data owner/provider, a mutual agreement on the regular automated data transfer will be signed, specifying scope, time schedule and transfer schemes. So far it was not necessary within the GTN-R, but the experiences of ETN-R seem to consider written agreements on various levels.

5.4 Establish a routine for the automated data transfer in near real-time

The software system which will collect, harmonise and redistribute the near real-time data will be developed within the ETN-R project. The version 3.0 of the GRDC NRT data format is already in use within GTN-R.

GRDC will apply the ETN-R software system to the GTN-R as soon as it is in regular operation, latest by the end of the ETN-R project in December 2008. Designed primarily for the ETN-R, the system must be adapted for the requirements of the GTN-R considering the experiences of the ETN-R. The re-use of the developed software is agreed by the EC-JRC, the sponsor of the ETN-R.

5.5 Compilation of the station inventory (metadata collection)

The simplest metadata compilation results from the composition of all received station and provider information. Because of the wide variety of the provided metadata from a basic (river and station name, coordinates, contact details) to a detailed description of the observing and transmission schemes, the definition of common denominators and the application of a standardised vocabulary is strongly recommended. The metadata provision by the providers should be as easy as feasible and the processing should be done as automated as possible.

As described in section 3.5., no product for the gathering and management of hydrological metadata is re-usable internally from the ETN-R project. Nevertheless, a web-based, multilingual software product for the exploration of metadata portable to other platforms and capable of being spread out is still the most suitable solution. It would facilitate the metadata collection and processing on both the providers (NHS) and the processors (GRDC) side.

Because the GRDC has no own capacities for the development of such a software, the software development by an external company, based on the most up-to-date version of the WMO Core metadata profile, is favoured. Whilst no capable software product is available, the metadata used for the station selection will be stored offline. A summary of the already provided metadata of the tentative station network will be provided by the GRDC on the GTN-R website at http://grdc.bafg.de/servlet/is/9465/ .

5.6 Map product on Real-Time Hydrological Conditions (GRDC NRT Monitor)

The intended visualisation of the actual hydrologic situations in a map depends on up-to-date data and the availability of reliable thresholds to put the incoming data into perspective. With respect to the low rate of reply and the still outstanding finalisation of the GTN-R network, the mapping application currently is of lower significance compared to the definition of reference stations, in the sense “No reliable data, no acceptable mapping”.

Like for the data harvesting software, the re-use of the ETN-R schemes is intended for the development of the mapping application, the GRDC NRT Monitor. Within the ETN-R the development of a customised mapping application is planned to display the present and the forecasted river discharges. GRDC intends to apply the ETN-R mapping application as soon as it is in operation, latest by the end of the ETN-R project in December 2008.

5.7 Information through the GTN-R website

The GTN-R website (http://gtn-r.bafg.de/) includes general information about the GTN-R and the project progress. Up-to date information about the meetings, deliverables, and related documents are given there. The University of New Hampshire, UNH, reports about the GTN-H forthcoming on the GTN-H website (http://gtn-h.unh.edu/PHP/index.php).

Regarding all IT services including the design of the internet presence, GRDC depends on the technical development in the Federal Institute of Hydrology (BfG), the hosting institution. Currently for the design of websites the WebGenesis, a German framework for generating and supporting web-based information systems, is in use. The migration to a new content management system, the German Government Site Builder, is planned for 2008.

6. Literature

GCOS (2000): Establishment of a Global Hydrologic Observation Network for Climate. Report of the GCOS/GTOS/HWRP Expert Meeting, Geisenheim, Germany, June 26-30, 2000. J. Cihlar, W. Grabs, and J. Landwehr (Editors), (GCOS-63; GTOS-26) (WMO/TD-No. 1047). (Report online available at http://www.fao.org/gtos/doc/pub26.pdf)

GCOS (2002): Report of the GCOS/GTOS/HWRP Expert Meeting on the Implementation of a Global Terrestrial Network - Hydrology (GTN-H), Koblenz, Germany, June 21-22, 2001. W. Grabs and A.R. Thomas (Editors), (GCOS-71; GTOS-29) (WMO/TD-No. 1099). (Report online available at http://www.wmo.ch/web/gcos/Publications/gcos-71.pdf)

GCOS (2004): Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC, (GCOS-92) (WMO/TD-No. 1219). (Report online available at http://www.wmo.ch/web/gcos/Implementation_Plan_(GCOS).pdf)

GCOS (2005): Report of the 2nd GTN-H Coordination Panel meeting, Koblenz, Germany, 4-5 July 2005. (WMO/TD-No. 1298). (Report online available at http://www.fao.org/gtos/gtospub/pub37.html)

GRDC (2003): Development of an Operational Internet-based Near real-time Monitoring Tool for Global River Discharge Data: a contribution to the Global Terrestrial Network for Hydrology (GTN-H). Thomas Maurer (GRDC report series 23) (Report only online available at http://grdc.bafg.de/servlet/is/911/)

GRDC (2003): Development of an Operational Internet-based Near Real Time Monitoring Tool for Global River Discharge Data / Thomas. Maurer (GRDC report series 30) (Report online available at http://grdc.bafg.de/servlet/is/911/)

GRDC (2005): Service provision for real-time access to European river discharge and water level data : offer to the European Commission's Joint Research Centre (JRC). Status: 11 November 2005 / Thomas Maurer (internal document)

GRDC (2007a): GRDC Specification, GRDC Near Real-Time Data Format Version 3.0. Maik Bunschkowski (internal project report)

GRDC (2007b): European Terrestrial Network for River Discharge (ETN-R) – Homepage. Kirsten Overmann (Editor). (http://etn-r.grdc.bafg.de)

GRDC (2007c): ETN-R System Design Document. Maik Bunschkowski (internal project report)

ANNEXES

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(Addressees of the invitation letter of the WMO-SG)
Annex II: GTN-R stations confirmed or added by the NHS, sorted by WMO region and country
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Annex V: Supplementary information (metadata) for the GTN-R
Annex VI: Status of contributions to the ETN-R by country
Annex VII: Identified and established contacts of the ETN-R
Annex VIII: Status of contributions to ETN-R and to GTN-R (European countries) as of July 2007
Annex IX: Metadata required for the ETN-R

Annex I: Countries and institutions initially contacted within GTN-R (Addressees of the invitation letter of the WMO-SG)

Country	Institution	Name of Contacted Person	Position of Contacted Person
Algeria	Office National de la Météorologie	Mr Abdelmalek KIROUANE	Directeur général
Algeria	Agence Nationale des Ressources Hydrauliques (ANRH)	Mr Rachid Taibi	Directeur Generale
Angola	Instituto Nacional de Hidrometeorologia e Geofisica - INAMET	The Hydrological WMO	
Angola	Instituto Nacional de Hidrometeorologia e Geofisica - INAMET	Dr Gualberto DE HONORATO JOAO	Directeur
Argentina	Servicio Meteorologico Nacional	Mr Miguel Angel RABIOLO	
Argentina	Subsecretaria de Recursos Hidricos de la Nación	Mr Miguel Angel Giraut	
Argentina	Subsecretaria de Recursos Hidricos de la Nación	Mr Victor Pochat	Director
Argentina	Servicio Meteorológico National	Major Carlos Alberto DAMBORIANA	
Australia	Bureau of Meteorology	Dr Geoff B. LOVE	
Australia	Hydrology Program Office	Mr Ross James	Supervising Engineer Water Resources
Australia	Natural Resource Management	Mr Ian THOMPSON	Executive Manager
Azerbaijan	State Hydrometeorological Committee - Hydromet Azerbaijan	Mr Mirzakhan R. MANSIMOV	
Azerbaijan	State Hydrometeorological Committee	The Permanent Representative	
Bangladesh	Bangladesh Water Development Board (BWDB)	Mr S. K. Chowdhury	
Bangladesh	Meteorological Department	Mr Md. Akram HOSSAIN	
Benin	Service météorologique national	The Hydrological Adviser of Benin	Directeur de l'Hydraulique
Benin	Service météorologique national	Mr Amédée LAWSON	
Botswana	Department of Water Affairs	Mr Kalaote KALAOTE	Director
Botswana	Botswana Meteorological Services	Ms G.K. RAMOTHWA	Director
Brazil	Instituto Nacional de Meteorologia (INMET)	Dr Antonio Divino MOURA	
Brazil	Agência Nacional de Águas - ANA	Dr Oscar Netto de Moraes Cordeiro	
Cambodia	Ministry of Water Resources and Meteorology (MOWRAM)	Son Excellence M. LIM Kean Hor	

Country	Institution	Name of Contacted Person	Position of Contacted Person
Cameroon	ORSTOM Yaounde	Mr Daniel SIGHOMNOU	Chef du Centre de Recherches Hydrologigiques (CRH)
Cameroon	Direction de la météorologie nationale	Mr Hilary MBIFNGWEN BONGMUM	
Canada	Meteorological Service of Canada	Mr Ted R. Yuzyk	National Manager
Canada	Meteorological Service of Canada (MSC)	Dr Marc Denis EVERELL	Assistant Deputy Minister
Chad	Direction des Ressources en eau et de la Météorologie Service Hydrologique	Mr Tchitchaou MOUSSA	Directeur
Chad	Direction des Ressources en eau et de la Météorologie	Mr Jeremie Alainaye DJOGROMEL	Chef de Service Hydrologique National
Chile	Direccion General de Aguas	Mr Javier F. NARBONA	
Chile	Direccion Meteorologica de Chile	Mr Hugo Oliva Haupt	Director
Chile	Centro de Informacion de Recursos Hidricos	Mr Erich Weidenslaufer	
China	China Meteorological Administration	Prof Dr Dahe QIN	Director
China	Bureau of Hydrology	Dr Professor Jianyun ZHANG	Vice Director, Chief Engineer
Colombia	Instituto de Hidrologico, Meteorologica y Estudios Ambientales (IDEAM)	Dr Carlos COSTA-POSADA	Director-General
Colombia	Instituto Colombiano de Hidrologia, Meteorologia y Adecuacion de Tierras (HIMAT)	Dr Hebert GONZALO RIVERA	Subdirector de Hidrologia
CÔTE D'IVOIRE	Direction de la météorologie nationale (DMN/SODEXAM)	Mr Goroza Guehi	
Côte d'Ivoire	Direction de l'Eau	Ms Saramatou KONE BAHIRE	
Dem. Republic of the Congo	Voies navigables	Mr M. NDOMBASI	Directeur aux Voies Navigables
Dem. Republic of the Congo	Agence nationale de météorologie et de Télédétection par satellite (METTELSAT)	The Permanent Representative	Directeur général
Denmark	Department of Streams and Riparian Areas	Mr Niels Bering Ovesen	
Denmark	Forecasting Services Department	Dr Peter AAKJAER	Director
Ecuador	Instituto Nacional de Meteorologia e Hidrologia (INAMHI)	Ing. Gustavo GOMEZ	Director de Hidrología

Country	Institution	Name of Contacted Person	Position of Contacted Person
Ecuador	Instituto Nacional de Meteorologia e Hidrologia (INAMHI)	Ing. Gustavo GARCÍA DÁVILA	Director Ejecutivo
Egypt	Ministry of Public Works and Water Resources	Dr Abdel Fattah Metawie	
Egypt	Egyptian Meteorological Authority	Eng. Mourad Shawky Saadallah	
El Salvador	Servicio Nacional de Estudios Territoriales (SNET)	Mr Antonio Arenas	General Director
El Salvador	Servicio Meteorológico a Hidrológico	Ms Ing. Ana Deisy LÓPEZ RAMOS	
Finland	Finnish Meteorological Institute	Prof. Petteri TAALAS	Director-General
Finland	Finnish Environment Institute (SYKE)	Mr Hannu Sirviö	
Finland	Finnish Environment Institute Ymparisto	Dr Markku Puupponen	Division Manager
France	Cemagref Head Office	Mr Pierrick GIVONE	Deputy director scientific
France	Météo-France	Mr Jean-Pierre BEYSSON	Directeur général
France	Service Central d'Hydrométéorologie et d'Appui à la Prévision des Inondations (SCHAPI)	Mr Jean-Marie Carriere	Adjoint
France	Service Central d'Hydrométéorologie et d'Appui à la Prévision des Inondations (SCHAPI)	Mr Jean-Michel Tanguy	Directeur
Gabon	Direction de la météorologie nationale	Mr Jean Damien MALOBA MAKANGA	Directeur
Ghana	Meteorological Services Department	Mr F. P. MOTE	
Ghana	Commission for Hydrology of WMO	Mr Julius Wellens-Mensah	Vice-President
Honduras	Servicio Meteorológico Nacional	Mr Nabil KAWAS	
Iceland	Hydrological Service	Mr Kristinn Einarsson	Chief Project Manager, Hydrologist
Iceland	Icelandic Meteorological Office	Mr Magnus JOHNSSON	Director
Iceland	National Energy Authority	Dr Arni Snorrason	Chief of the Hydrological Division
India	Central Water Commission	Mr Shri S. K. DAS	Member (D&R)
India	India Meteorological Department	Dr Suresh K. SRIVASTAV	Additional Director-General of Meteorology
Indonesia	Research Institute for Water Resources (RIWR)	Ms Dyah Rahayu PENGESTI	Director
Indonesia	Bureau of Meteorology and Geophysics (BMG)	Dr Gunawan IBRAHIM	Head

Country	Institution	Name of Contacted Person	Position of Contacted Person
Iraq	Iraqi Meteorological Organization	Dr Dawood S. Mahmood	
Iraq	Iraqi Meteorological Organization	Mr Hussain Ali FAHAD	
Islamic Republic of Iran	Islamic Republic of Iran Meteorological Organization (IRIMO)	Dr Ali Mohammad NOORIAN	Vice-Minister of Road and Transportation
Islamic Republic of Iran	Islamic Republic of Iran Meteorological Organization (IRIMO)	H. E. Mr R. ZARGAR	Vice-Minister of Energy in Water Affairs
Italy	Agenzia per la Protezione dell'Ambiente e per i Servizi Tecnici (APAT)	Ms Ing. Giuseppina MONACELLI	Acting Director
Italy	Ufficio Generale per la Meteorologia	General Roberto SORANI	Relazioni Esterne
Japan	Japan Meteorological Agency (JMA)	Mr Koichi NAGASAKA	
Japan	River Bureau, Ministry of Land, Infrastructure and Transport	Mr Masato Seiji	
Kazakhstan	Republican State-Owned Enterprise "KAZHYDROMET"	Mr Tursynbek KUDEKOV	Director
Kenya	Meteorological Department	Dr Joseph Romanus MUKABANA	Director
Kenya	Ministry of Environment and Natural Resources, Water Development	Mr Kiptui George CHESANG	Director
Latvia	Latvian Hydrometeorological Agency	Ms Anda Bakute	
Latvia	Latvian Hydrometeorological Agency	Ms Iraida Lyulko	Head Observational Network Department
Latvia	Latvian Hydrometeorological Agency	Mr Andris LEITASS	Director
Latvia	Latvian Hydrometeorological Agency	Mr Yeugenij ZAHARCHENKO	
Lithuania	Lithuanian Hydrometeorological Service	Mr Vytautas Bernadisius	Head
Lithuania	Lithuanian Hydrometeorological Service	Mr Juozas Šimkus	Hydrologist
Madagascar	Direction de la Météorologie et de Hydrologie	Mr Nimbol RALINERA	Director-General
Madagascar	Service de l´hydrologie	Mr Helison Romuald RAZAFINDRAKOTO	Chef de la Division d'appui aux études et recherches hydrologiques
Malawi	Water Department	Mr A. B. CHIRWA	Secretary for Water Development
Malawi	Meteorological Services	Mr Donald Reuben KAMDONYO	Director
Malawi	Southern Region Office	Mr Geoffrey C. Mamba	Regional Water Development Officer

Country	Institution	Name of Contacted Person	Position of Contacted Person
Malaysia	Hydrology and Water Resource Division for Director General	Mr Azmi Md. Jafri	Senior Assistant Director
Malaysia	Malaysian Meteorological Service	Dr Kok Kee CHOW	Director-General
Mexico	Comisión Nacional del Agua	Dr Francisco Javier APARICIO MIJARES	Coordinator of Hydrologic Technology
Mexico	Comisión Nacional del Agua	Dr Moisés Michel ROSENGAUS MOSHINSKY	Coordinator del Servicio Meteorológico Nacional
Mexico	Comisión Nacional del Agua	Mr Carlos Marsch Moreno	
Morocco	Administration de l'Hydraulique	Mr Abddaim LAHMOURI	Chef de la Division des Ressources en Eau
Morocco	Direction de la météorologie nationale	Mr Mustapha Geanah	
Mozambique	Direccion Nacional de Agua	Mr Américo MUIANGA	Director
Mozambique	Instituto Nacional de Meteorologia	Mr Filipe Domingos FREIRES LECIO	Director
Myanmar	Department of Meteorology and Hydrology	Dr San Hla THAW	Assistant Director, Electronics Division
Namibia	Department of Water Affairs	Mr Guido van Langenhove	Head, Hydrological Services
Namibia	Meteorological Services	Mr F. UIRAB	Chief
New Zealand	MetService	Mr John R. LUMSDEN	Chief Executive
New Zealand	National Institute of Water & Atmospheric Research Ltd. (NIWA)	Mr Charles PEARSON	
Nicaragua	Instituto Nicaragüense de Estudios Territoriales (INETER)	Ing. Claudio Gutiérrez HUETE	Director-General
Nicaragua	Instituto Nicaragüense de Estudios Territoriales (INETER)	Ing. Luis Sandor Palacios RUIZ	Director Técnico de la Direccion de Recursos Hídricos
Niger	Direction de la météorologie nationale	Mr Moussa LABO	Chef, Service Agrométéorologie
Niger	Ministère de l'Hydraulique, de l'Environnement et de la Lutte V	Dr Abdou GUERO	Directeur des Ressources en Eau
Nigeria	Nigerian Meteorological Agency	Mr Lihwu Eugene AKEH	Director
Nigeria	Department of Hydrology and Hydrogeology	Mr Mohammed Hamisu IBRAHIM	
Norway	Norwegian Meteorological Institute	Prof. Anton ELIASSEN	
Norway	Norwegian Water Resources and Energy Directorate	Mr Morten Johnsrúd	Director of Hydrology Department
Norway	Norwegian Water Resources and Energy Directorate	Mr Lars Andreas Roald	Senior Hydrologist

Country	Institution	Name of Contacted Person	Position of Contacted Person
Pakistan	Pakistan Meteorological Department (Headquarters Office)	Dr Qamar-uz-Zaman CHAUDHRY	Director-General
Pakistan	National Flood Forecasting Bureau (NFFB)	Mr Shaukat Ali AWAN	Director
Papua New Guinea	National Weather Service	Mr Kevin Luana	
Papua New Guinea	Water Resources Management Branch	Mr Maino VIROBO	
Peru	Servicio Nacional de Meteorología e Hidrología (SENAMHI)	Mayor General FAP Juan Oviedo Motta	Jefe del SENAMHI
Peru	Dirección General de Hidrología y Recursos Hídricos	Ing. Jorge Yerrén SUÁREZ	Director General de Hidrología
Poland	Institute of Meteorology and Water Management	Prof. Dr Jan Zielinski	Director
Portugal	Instituto de Meteorologia	Prof. Adérito Vicente SERRIO	President
Portugal	Instituto de Agua		Director
Republic of Moldova	Hydrometeorological Service	Mr Igor V. GREPACHESKY	
Republic of Moldova	State Service "Hydrometeo"	Mr Valeriu Cazac	Director
Republique du Congo	Service météorologique national	Mr Bienvenu MAZIEZOULA	Ingénieur hydrotechnicien
Republique du Congo	Service météorologique national	Mr Pierre ONDONGO	Directeur
Romania	Romanian Air Traffic Services Administration	Dr Petre Stanciu	Scientific Director for Hydrology
Romania	National Meteorological AnministrationIE LžI HIDROLOGIE	Dr Ion Sandu	
Romania	National Institute of Hydrology and Water Management	Ms Emilia Branescu	
Russian Federation	Russian Federal Service for Hydrometeorology and Environmental Monitoring	Dr Alexander I. BEDRITSKY	Head
Russian Federation	All-Russian Research Institut of Hydrometeorological Information	Dr Vyacheslav N. Razuvaev	
Senegal	Ministère de l'hydraulique	The Hydrological Adviser of Senegal	
Senegal	Ministère du Tourisme et des Transports Aériens	Mr Mactar Ndiaye	Directeur
Socialist Republic of Viet Nam	Hydrometeorological Service of the Socialist Republic of Viet Nam	Dr Nguyen Cong Thanh	Director General
South Africa	South African Weather Service	Mr R.D. Jeremiah LENGOASA	Chief Executive Officer
South Africa	Department of Water Affairs and Forestry	Mr Stéfan VAN BILJON	Director Hydrology

Country	Institution	Name of Contacted Person	Position of Contacted Person
South Africa	Department of Water Affairs & Forestry	Ms Francinah Sibanyoni	
Spain	Direccion General de Obras Hidaulicas y Calidad de las Aguas	Dr Eng. Alberto Rodriguez Fontal	Jefe del Servicio de Recursos Hidricos
Spain	Centro de Estudios Hidrogáficos (CEDEX)	Dr Manuel Menéndez	Head
Spain	Instituto Nacional de Meteorologia	Mr Antonio Mestre-Barcelo	
Spain	Instituto Nacional de Meteorologia	Mr D. Cadarso	
Suriname	Meteorological Service	Mr Moekiram AMATALI	
Suriname	Ministry of Public Works	Mr Cornelis R. BECKER	Director
Sweden	Swedish Meteorological and Hydrological Institute (SMHI)	Ms Maria Agren	
Sweden	Swedish Meteorological and Hydrological Institute	Mr Marcus Flarup	
Sweden	HOMS Nordic Reference Centre	Ms Gunlög Wennerberg	Director
Switzerland	c/o Permanent Mission of Somalia to the Office of the United Nations and the other International Organizations in Geneva	The Permanent Representative	
Thailand	Ministry of Information and Communication Technology	Ms Muntana BRIKSHAVANA	Director
Thailand	The Thai Meteorological Department	Ms Watcharee Virapun	Chief, Hydro-Meteorological Academic Group
The Netherlands	Royal Netherlands Meteorological Institute	Dr Frits J. J. BROUWER	Director
The Netherlands	Wageningen University	Prof. Dr Piet M. M. Warmerdam	
The Netherlands	RWS, Rijksinstitut for Kust en Zee (RIKZ)	Mr Koos Doekes	
Turkey	Irrigation and Planning Department, Hydrology Section	Mr Hamza Ozguler	Hydrological Expert
Ukraine	Hydrometeorological Centre	Mr Viacheslav N. LIPINSKY	Chairman
United Kingdom	Centre for Ecology & Hydrology	Dr Ann Calver	
United Kingdom	Centre for Ecology and Hydrology (CEH)	Mr Terry Marsh	National Water Archive
United Kingdom	Met Office	Dr David ROGERS	Chief Executive
United Kingdom	CEH Wallingford	Ms Felicity Sanderson	
United Republic of Tanzania	Ministry of Water, Energy and Minerals	Mr Julius M. Mihayo	Head of Hydrological Services

Country	Institution	Name of Contacted Person	Position of Contacted Person
United Republic of Tanzania	Tanzania Meteorological Agency	Dr Mohamed S. MHITA	Director-General
United States	US Geological Survey	Mr Robert M. Hirsch	Chief Hydrologist
United States	NOAA/National Weather Service	Brigadier General John J. KELLY Jr.	Assistant Administrator for Weather Services, NOAA
United States	Office of Surface Water	Mr Harry Lins	
United States	Joint Office for Science Support (JOSS)	Mr Steve F. Williams	Field Data Specialist
Uruguay	Dirección Nacional de Hidrografia	Mr Carlos Alejandro ARCELUS	
Uruguay	Dirección Nacional de Meteorologia	Lic. Raul MICHELINI	Director Nacional de Meteorologia
Uruguay	Dirección Nacional de Hidrografía (DNH)	Mr Carlos Pollio	Director
Uzbekistan	Central Asian Research Scientific Hydrometeorological Institute	Dr Sergei MYAGKOV	Deputy Director
Uzbekistan	Centre of Hydrometeorological Service at Cabinet of Ministers of the Republic of Uzbekistan (Uzhydromet)	Prof. Dr Viktor E. Chub	Minister, General Director
Venezuela	Dirección de Hidrología y Meteorología	Ms Ing. Carmen FERMÍN R.	
Venezuela	Servicio de Meteorología de la Aviacion	Coronel (AV.) Ramón Jesús VIÑAS GARCÍA	

Annex II: GTN-R stations confirmed or added by the NHS, sorted by WMO region and country

(A detailed list of received metadata is available at http://gtn-r.bafg.de/servlet/is/9465/)

WMO-Region	GTNR_STN_COUNTRY	GTNR_STN_STATION	GTNR_STN_RIVER	COMMENT	NATIONAL_ID	GRDC_NO	LAT_DD	LONG_DD	ALT_M	AREA_KM2
1	ALGERIA	BAGHLIA	SEBAOU	added NHS	022001	1104530	36.8	3.87	20	2390
1	ALGERIA	MIREBECK	SEYBOUSE	added NHS	140601		36.744	7.77	10	5955
1	ALGERIA	P.DU CHAT	TAFNA	added NHS	160801		35.15	-1.45	50	6900
1	ALGERIA	SIDI AICH	SOUMMAM	added NHS	151001		36.61	4.68	80	8420
1	ALGERIA	SIDI BELATAR	CHELIFF	agreed NHS	013602	1104150	36.02	0.27	20	43700
1	BENIN	ATHIEME	MONO	agreed NHS	1114000107	1732100	6.92	1.67		21575
1	BENIN	BONOU	OUEME	agreed NHS	14500107	1733600	6.9	2.45		46990
1	CONGO	MAKOUA	LIKOUALA MOSSAKA	added NHS			0	15.67	322	14060
1	CONGO	SOUNDA	KOULIOU	agreed NHS		1445100	-4.1	12.07	8.34	55010
1	CONGO	TCHKAPIKA	ALIMA	added NHS			-1.3	16.17	310	20070
1	SOUTH AFRICA	AREA 8\004 SPRINGS B	GREAT KEI RIVER	added NHS	S7H004		-32.52	28.02		484
1	SOUTH AFRICA	DONKER HOEK ALICEDALE	BOESMANS RIVER	added NHS	P1H003	1160500	-33.33	26.08		1479
1	SOUTH AFRICA	DRIEHEUVELS	BERG RIVER	added NHS	G1H013		-33.13	18.86		2934
1	SOUTH AFRICA	HUIS RIVER	GAMKA RIVER	added NHS	J2H010		-33.5	21.62		7805
1	SOUTH AFRICA	MANDINI	TUGELA RIVER	agreed NHS	V5H002		-29.14	31.39		28920
1	SOUTH AFRICA	MATOMELAS LOCATION	GREAT FISH RIVER	agreed NHS	Q1H018	1160580	-33.24	26.99		29745
1	SOUTH AFRICA	MELKBOOM	DORING RIVER	added NHS	E2H003		-31.86	18.69		24044
1	SOUTH AFRICA	MIDMAR	MGENI RIVER	added NHS	U2H048		-29.5	30.2		928
1	SOUTH AFRICA	VIOOLSDRIF	ORANGE RIVER	agreed NHS	D8H009	1159100	-28.77	17.63		851580
2	CHINA	BENGBU	HUAI HE	agreed NHS	51080	2181950	32.93	117.38		121330
2	CHINA	BOLUO	DONG JIAN	agreed NHS	87141	2186950	23.17	114.3		25325
2	CHINA	CHILING	LIAO HE	agreed NHS	23004	2179100	42.2	123.5		120764
2	CHINA	DALINGHE	DALING HE	agreed NHS	25318	2178400	41.18	121.37		17687
2	CHINA	DATONG	CHANG JIANG	agreed NHS	60315	2181900	30.77	117.62		1705383

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2	CHINA	GUANTING (GUANKING)	YONG DING	agreed NHS	33620	2178300	40.23	115.6		42500
2	CHINA	HUAYUANKOU	HUANG HE	agreed NHS	41330	2180800	34.92	113.65		730036
2	CHINA	LUAN XIAN	LUAN HEI	agreed NHS	31654	2178500	39.73	118.75		44100
2	CHINA	SHIJIAO	BEI JIANG	agreed NHS	86124	2186901	23.57	112.95		38363
2	CHINA	WUZHOU	XI JIANG	agreed NHS	81016	2186800	23.48	111.3		329705
2	MYANMAR	HKAMTI	CHINDWIN	agreed NHS		2260100	26	95.7	142	27410
2	MYANMAR	HPA_AN	THANLWIN (SALWEEN)	added NHS			16.5	97.4	12.821	295270
2	MYANMAR	SAGAING	IRRAWADDY	agreed NHS		2260500	21.98	96.1	70.243	117900
2	MYANMAR	TOUNGOO	SITTOUNG	agreed NHS		2261500	18.92	96.47	44.282	14660
3	COLOMBIA	CALAMAR	MAGDALENA	agreed NHS	2903702	3103300	10.27	-74.92	8	257438
3	COLOMBIA	MOCARI	SINU	added NHS	1307710		8.87	-75.85	14	
3	ECUADOR	A.J. AMARILLO	PINDO	added NHS	H587	3846510	-3.7572	-79.6347	563	543
3	ECUADOR	A.J.AMARILLO	CALERA	added NHS	H586	3846500	-3.6733	-79.6395	680	2525
3	ECUADOR	A.J.GUACHALA	GRANOBLES	added NHS	H143	3844150	0.0221	-78.1667	416	2750
3	ECUADOR	A.J.PILATON	TOACHI	added NHS	H161	3844200	-0.3093	-78.9508	820	1435
3	ECUADOR	CATARAMA	ZAPOTAL	added NHS	H345	3844460	-1.5692	-78.476	40	3720
3	ECUADOR	D.J.CARIYACU	AMBI	added NHS	H023	3843500	0.3722	-78.207	2015	686
3	ECUADOR	D.J.SADE	ESMERALDAS	agreed NHS	H168	3844100	0.53	-79.42	50	18800
3	ECUADOR	D.J.SAN FRANCISCO	JUBONES	added NHS	H529	3844800	-3.3048	-79.503	680	3320
3	ECUADOR	LA CAPILLA	DAULE	agreed NHS	H365	3844400	-1.7	-80	13	8690
3	ECUADOR	LECHUGAL	ZAPOTAL	added NHS	H346	3844465	-1.3858	-79.3525	18	2980
3	ECUADOR	LITA	MIRA	agreed NHS	H011	3843100	0.9	-78.47	475	4960
3	ECUADOR	QUEVEDO	QUEVEDO	added NHS	H347	3844300	-1.0175	-79.4572	125	3507
3	ECUADOR	VINCES-DCP	VINCES	agreed NHS	H348	3844450	-1.53	-79.75	41	4400
3	PERU	EL TIGRE	TUMBES	added NHS	200202		-3.72	-80.47	40	
3	PERU	HUATIAPA	MAJES	agreed NHS	204618	3948900	-15.99	-72.47	699	13212

WMO-Region	GTNR_STN_COUNTRY	GTNR_STN_STATION	GTNR_STN_RIVER	COMMENT	NATIONAL_ID	GRDC_NO	LAT_DD	LONG_DD	ALT_M	AREA_KM2
3	PERU	LA CAPILLA (PE)	MALA	added NHS	203102	3844400	-12.52	-76.5	424	2121
3	PERU	LA PASCANA	TAMBO	added NHS	204905		-16.99	-71.64	281	11618
3	PERU	PUENTE OCONA	RIO OCONA	added NHS	204504		-16.42	-73.11	23	
3	PERU	SAYAN	HUAURA	added NHS	202608	3948600	-11.12	-77.18	650	2871
3	PERU	SOCSI	CANETE	added NHS	203302		-13.03	-76.19	330	5814
4	CANADA	A LA CHUTE ROUGE	WASWANIPI (RIVIERE)	added NHS	03AB002	4214655	49.86	-77.19		31900
4	CANADA	A LA MARINA DE SAINTE-ANNE-DE-BELLEVUE	OUTAOUIAS (RIVIERE DES)	added NHS	02OA033		45.4	-73.95		
4	CANADA	A LA SORTIE DU LAC QUENONISCA	BROADBACK (RIVIERE)	added NHS	03BD002	4214670	50.75	-76.39		9820
4	CANADA	ABOVE COPPER CREEK	COPPERMINE RIVER	added NHS	10PC004	4209401	67.23	-115.89		46200
4	CANADA	ABOVE FORT MCPHERSON	PEEL RIVER	agreed NHS	10MC002	4208040	67.24	-134.89		70600
4	CANADA	ABOVE HERMANN RIVER	BACK RIVER	added NHS	10RC001	4209805	66.09	-96.51		93900
4	CANADA	ABOVE KAZAN FALLS	KAZAN RIVER	agreed NHS	06LC001	4214090	63.65	-98.85		70000
4	CANADA	ABOVE MOOSE RIVER	MOOSE RIVER	agreed NHS	04LG004	4214551	50.75	-81.45		60100
4	CANADA	ABOVE OUTLET SEALHOLE LAKE	THLEWIAZA RIVER	agreed NHS	06HB002	4214070	60.79	-114.19		27000
4	CANADA	ABOVE QNSLR BRIDGE	MOISIE (RIVIERE)	added NHS	02UC002	4243800	50.35	-66.19		19000
4	CANADA	ABOVE RED HEAD RAPIDS	CHURCHILL RIVER	agreed NHS	06FD001	4214270	58.12	-94.63		289000
4	CANADA	ABOVE SHUMAL CREEK	NASS RIVER	agreed NHS	08DB001	4206100	55.26	-129.09		18500
4	CANADA	ABOVE UPPER MUSKRAT FALLS	CHURCHILL RIVER	agreed NHS	03OE001	4244500	53.25	-60.8		92500
4	CANADA	AMOS	HARRICANAW RIVER	added NHS	04NA001	4214610	48.6	-78.18		3680
4	CANADA	ARCTIC RED RIVER	MACKENZIE RIVER	agreed NHS	10LC014	4208025	67.46	-133.74		911000
4	CANADA	BELOW ASHEWEIG RIVER TRIBUTARY	WINISK RIVER	agreed NHS	04DC001	4214450	54.5	-87.2333		50000
4	CANADA	BELOW CARNWATH RIVER	ANDERSON RIVER	agreed NHS	10NC001	4209150	68.63	-128.41		57800
4	CANADA	BELOW GODS RIVER	HAYES RIVER	agreed NHS	04AB001	4214025	56.43	-92.79		103000
4	CANADA	BELOW GREAT ISLAND	SEAL RIVER	agreed NHS	06GD001	4214105	58.89	-96.28		48200
4	CANADA	BELOW MUKETEI RIVER	ATTAWAPISKAT RIVER	agreed NHS	04FC001	4214080	53.09	-85.07		36000
4	CANADA	BELOW OUTLET OF SCHULTZ LAKE	THELON RIVER	agreed NHS	06MA006	4214051	64.78	-97.05		152000

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4	CANADA	BELOW SEA RIVER FALLS	NELSON RIVER (EAST CHANNEL)	added NHS	05UB008		54.24	-97.59		
4	CANADA	CHUTE DE LA PYRITE	CANIAPISCAU (RIVIERE)	agreed NHS	03FL002	4214040	57.43	-69.21		48500
4	CANADA	EN AMONT DE LA RIVIERE DENYS-1	BALEINE (GRANDE RIVIERE DE LA)	added NHS	03ED001	4214801	57.88	-76.98		36300
4	CANADA	EN AMONT DU LAC MATAGAMI	BELL (RIVIERE)	added NHS	03AC004	4214621	49.75	-77.61		22200
4	CANADA	EN AVAL DE LA DECHARGE DU LAC ALIECTE	NATASHQUAN (RIVIERE)	agreed NHS	02WB003	4244635	50.43	-61.71		15600
4	CANADA	EN AVAL DU LAC NEMISCAU	RUPERT (RIVIERE)	agreed NHS	03BC002	4214680	51.45	-76.87		40900
4	CANADA	GRAND FALLS	SAINT JOHN RIVER	added NHS	01FA002	4231602	47.04	-67.74		21900
4	CANADA	LA CENTRALE NO.2	BETSIAMITES (RIVIERE)	added NHS	02SB004		49.18	-69.23		16100
4	CANADA	LASALLE	SAINT-LAURENT (FLEUVE)	agreed NHS	03OA016	4243151	45.42	-73.62		-999
4	CANADA	MISSION	FRASER RIVER	added NHS	08MH024		49.13	-122.3		228000
4	CANADA	NEAR HAT ISLAND	ALBANY RIVER	agreed NHS	04HA001	4214520	51.33	-83.83		118000
4	CANADA	NEAR JUNEAU	TAKU RIVER	agreed NHS	08BB005	4202601	58.54	-133.7		17700
4	CANADA	NEAR THE MOUTH (ARCTIC RED RIVER)	ARCTIC RED RIVER	added NHS	10LA002	4208065	66.79	-133.08		18800
4	CANADA	NEAR THE MOUTH (ELLICE RIVER)	ELLICE RIVER	agreed NHS	10QD001	4209600	67.71	-104.14		16900
4	CANADA	NEAR THE PARK BOUNDARY	HORNADAY RIVER	added NHS	10OB001		69.18	-123.25		
4	CANADA	NEAR WRANGELL	STIKINE RIVER	added NHS	08CF003		56.7	-132.14		51600
4	CANADA	NEAR YAKUTAT	ALSEK RIVER	added NHS	08AB002		59.39	-138.08		
4	CANADA	PRES DE LA RIVIERE KOKSOAK	MELEZES (RIVIERE)	agreed NHS	03KC004	4214035	57.67	-69.61		42700
4	CANADA	PRES DE L'EMBOUCHURE-1	BALEINE (RIVIERE)	agreed NHS	03MB002	4214900	57.88	-67.58		29800
4	CANADA	RAPIDES FRYERS	RICHELIEU (RIVIERE)	added NHS	02OJ007	4243240	45.4	-73.26		22000
4	CANADA	TETE DE LA GORGE PROSPER	EASTMAIN (RIVIERE)	added NHS	03CB004		52.17	-74.59		21400
4	CANADA	USK	SKEENA RIVER	agreed NHS	08EF001	4206250	54.63	-128.43		42200
4	UNITED STATES	ABOVE CHIROSKEY RIVER NEAR UNALAKLEET RIVER, AK	UNALAKLEET RIVER	added NHS	15565700		63.9	-160.3	12.19	2714
4	UNITED STATES	BARING, ME	ST. CROIX RIVER	agreed NHS	1021000	4147060	45.1	-67.32	20.19	3559
4	UNITED STATES	BEAVER ARMY TERMINAL NEAR QUINCY, OR	COLUMBIA RIVER	agreed NHS	14516900	4115201	46.2	-123.2	0.16	665371

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4	UNITED STATES	BELOW CONCORD RIVER AT LOWELL, MA	MERRIMACK RIVER	agreed NHS	1100000	4147380	42.7	-71.3	1.58	12005
4	UNITED STATES	BELOW SKILAK LAKE OUTLET, AK	KENAI RIVER	added NHS	15266110	4102852	60.5	-150.6	73.15	3124
4	UNITED STATES	BELOW TUTAK CREEK NEAR KIVALINA, AK	WULIK RIVER	added NHS	15747000	4101200	67.9	-163.7	53.34	1826
4	UNITED STATES	BELOW YUMA MAIN CANAL WW AT YUMA, AZ	COLORADO RIVER	agreed NHS	9521100	4152050	32.7	-114.6	31.09	618715
4	UNITED STATES	CALALLEN, TX	NUECES RIVER	agreed NHS	8211500	4150283	27.9	-97.63	0.26	43823
4	UNITED STATES	CLAIRBORNE L&D NEAR MONROEVILLE	ALABAMA RIVER	added NHS	2428400	4149401	31.6	-87.51	0	55615
4	UNITED STATES	COFFEEVILLE L&D NEAR COFFEEVILLE, AL	TOMBIGBEE RIVER	agreed NHS	2469761	4149413	31.8	-88.13		477000
4	UNITED STATES	CONOWINGO, MD	SUSQUEHANNA RIVER	agreed NHS	1578310	4147703	39.7	-76.17	1.52	70189
4	UNITED STATES	CROOKED CREEK, AK	KUSKOKWIM	agreed NHS	15304000	4102100	61.9	-158.1	60.96	80549
4	UNITED STATES	DOCTORTOWN, GA	ALTAMAHA RIVER	agreed NHS	2226000	4148720	31.7	-81.83	7.46	35224
4	UNITED STATES	GAYLORDSVILLE, CT	HOUSATONIC RIVER	added NHS	1200500		41.65	-73.49	72.17	2580
4	UNITED STATES	GOLIAD, TX	SAN ANTONIO RIVER	agreed NHS	8188500	4150330	28.7	-97.38	27.76	10155
4	UNITED STATES	KINSTON, NC	NEUSE RIVER	added NHS	2089500	4148121	35.3	-77.58	3.32	6972
4	UNITED STATES	LOCK #1 NEAR KELLY, NC	CAPE FEAR RIVER	agreed NHS	2105769	4148232	34.4	-78.29	-0.88	13611
4	UNITED STATES	MERILL, MS	PASCAGOULA RIVER	added NHS	2479000	4149300	31	-88.73	8	17068
4	UNITED STATES	MORGAN CITY, LA	LOWER ATCHAFALAYA RIVER	added NHS	7381600		29.7	-91.2	0	-999
4	UNITED STATES	NEAR AGNESS, OR	ROGUE RIVER	agreed NHS	14372300	4145900	42.6	-124.1	34.69	10202
4	UNITED STATES	NEAR BELL, FL	SUWANNEE RIVER	agreed NHS	2323000	4149781	29.8	-82.92	1.1	24320
4	UNITED STATES	NEAR BOGALUSA, LA.	PEARL RIVER	agreed NHS	2489500	4149120	30.8	-89.82	16.76	17024
4	UNITED STATES	NEAR CLYO, GA	SAVANNAH RIVER	agreed NHS	2198500	4148650	32.5	-81.27	4.08	25512
4	UNITED STATES	NEAR CONCRETE, WA	SKAGIT RIVER	agreed NHS	12194000	4145081	48.5	-121.8	39.62	7089
4	UNITED STATES	NEAR CRESCENT CITY, CA	SMITH RIVER	added NHS	11532500	4146100	41.8	-124.1	24.16	1590
4	UNITED STATES	NEAR DENHAM SPRINGS, LA	AMITE RIVER	added NHS	7378500	4127941	30.5038	-90.99	0	3315
4	UNITED STATES	NEAR ELKTON, OR	UMPQUA RIVER	added NHS	14321000	4145700	43.6	-123.6	27.56	9539
4	UNITED STATES	NEAR FREDERICKSBURG, VA	RAPPAHANNOCK RIVER	added NHS	1668000	4147950	38.3	-77.53	21.34	4134

WMO-Region	GTNR_STN_COUNTRY	GTNR_STN_STATION	GTNR_STN_RIVER	COMMENT	NATIONAL_ID	GRDC_NO	LAT_DD	LONG_DD	ALT_M	AREA_KM2
4	UNITED STATES	NEAR GIVHANS, SC	EDISTO RIVER	added NHS	2175000	4148570	33	-80.39	6.24	7071
4	UNITED STATES	NEAR JUNEAU, AK	TAKU RIVER	added NHS	15041200		58.5	-133.7	15.24	17094
4	UNITED STATES	NEAR KLAMATH, CA	KLAMATH RIVER	agreed NHS	11530500	4146110	41.5	-124		31339
4	UNITED STATES	NEAR MONROE, WA	SNOHOMISH RIVER	added NHS	12150800	4145190	47.8	-122.1	4.04	3981
4	UNITED STATES	NEAR PUMP STATION 3, AK	SAGAVANIRKTOK RIVER	added NHS	15908000		69	-148.8	350.2	4817
4	UNITED STATES	NEAR RICHMOND, VA	JAMES RIVER	agreed NHS	2037500	4148050	37.6	-77.55	30.12	17503
4	UNITED STATES	NEAR RULIFF, TX	SABINE RIVER	agreed NHS	8030500	4150700	30.3	-93.74	-1.8	24162
4	UNITED STATES	NEAR SPRECKELS, CA	SALINAS RIVER	agreed NHS	11152500	4146400	36.6	-121.7	6.27	10764
4	UNITED STATES	NEAR SUMATRA, FL	APALACHICOLA	agreed NHS	2359170	4149632	30	-85.02		49728
4	UNITED STATES	NEAR TALKEETNA, AK.	TALKEETNA RIVER	added NHS	15292700	4102450	62.4	-150	121.92	5170
4	UNITED STATES	NEAR VERNALIS, CA	SAN JOAQUIN RIVER	agreed NHS	11303500	4146360	37.7	-121.3	7.62	35058
4	UNITED STATES	NEAR WASHINGTON, DC LITTLE FALLS PUMP STATION	POTOMAC RIVER	added NHS	1646500		39	-77.13	11.57	29940
4	UNITED STATES	NEAR WRANGELL, AK	STIKINE RIVER	agreed NHS	15024800	4204900	56.7	-132.1	7.62	51593
4	UNITED STATES	PALMER, AK	MATANUSKA RIVER	added NHS	15284000	4102310	61.6	-149.1	52.1	5361
4	UNITED STATES	PEEDEE, SC	PEE DEE RIVER	agreed NHS	2131000	4148300	34.2	-79.55	7.54	22870
4	UNITED STATES	PILOT STATION, AK	YUKON RIVER	agreed NHS	15565447	4103200	61.9	-162.9	6.1	831390
4	UNITED STATES	PUYALLUP, WA	PUYALLUP RIVER	added NHS	12101500	4145180	47.2	-122.3	0	2455
4	UNITED STATES	RICHMOND, TX	BRAZOS RIVER	agreed NHS	8114000	4150500	29.6	-95.76	8.52	1168270
4	UNITED STATES	ROANOKE RAPIDS, NC	ROANOKE RIVER	agreed NHS	2080500	4148090	36.5	-77.63	13.36	21715
4	UNITED STATES	ROMAYOR, TX	TRINITY RIVER	agreed NHS	8066500	4150600	30.4	-94.85	7.9	44512
4	UNITED STATES	SCOTIA, CA	EEL RIVER	agreed NHS	11477000	4146180	40.5	-124.1	10.82	8063
4	UNITED STATES	THOMPSONVILLE, CT	CONNECTICUT RIVER	agreed NHS	1184000	4147460	42	-72.61	11.73	25019
4	UNITED STATES	TRENTON, NJ	DELAWARE RIVER	agreed NHS	1463500	4147600	40.2	-74.78		17560
4	UNITED STATES	UMIAT, AK	COLVILLE RIVER	added NHS	15875000		69.4	-152.12	83.82	35820
4	UNITED STATES	VICKSBURG, MS	MISSISSIPPI RIVER	agreed NHS	7289000	4127800	32.3	-90.91	14.09	2964255

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4	UNITED STATES	WHARTON, TX	COLORADO RIVER	agreed NHS	8162000	4150450	29.3	-91.1	15.98	108788
5	PAPUA NEW GUINEA	AIOME	RAMU RIVER	added NHS	203800		-5.1	144.67	80	8751
5	PAPUA NEW GUINEA	AMBUNTI	SEPIK RIVER	agreed NHS	105950	5550500	-4.22	142.16	40	40922
5	PAPUA NEW GUINEA	KAREMA	BROWN RIVER	added NHS	607300		-9	147.2	15	1400
5	PAPUA NEW GUINEA	WABO CREEK	PURARI RIVER	agreed NHS	712400		-7	145.07	40	28734
6	GERMANY	INTSCHEDE	WESER	agreed NHS		6337200	52.964	9.12	4.79	37720
6	GERMANY	NEU-DARCHAU	ELBE	agreed NHS		6340110	53.232	10.889	5.68	131950
6	GERMANY	REES	RHEIN	agreed NHS		6335020	51.75	6.4	8	159300
6	ICELAND	SELFOSS	OELFUSA	agreed NHS	64/V064	6401090	63.9381	-21.0067		5678
6	ICELAND	UPPTYPPINGAR	JOEKULSA A FJOELLUM	added NHS	162/V289		65.03	-16.25		
6	LATVIA	DAUGAVPILS	DAUGAVA	agreed NHS		6973300	56.8	24.6		64500
6	MOLDOVA	BENDERY	DNIESTR	agreed NHS		6981800	46.8	29.37		66100
6	NETHERLANDS	BORGHAREN	MAAS	added NHS		6421500	50.87	5.72		21301
6	NORWAY	DOVIKFOSS	DRAMSELVA	agreed NHS	1200068000	6731310	59.89	9.91		16120
6	NORWAY	GAULFOSS	GAULA	added NHS	12200009000		63.11	10.23	45	3079
6	NORWAY	HEISEL	OTRA	added NHS	2100011000		58.25	7.95	8	3689
6	NORWAY	HOLMSFOSS I NUMEDALSLAGEN	NUMEDALSLAGEN	added NHS	1500061000		59.19	9.99	11	5205
6	NORWAY	KILEFJORD	OTRA	added NHS	2100034000		58.41	7.77	170	3347
6	NORWAY	KISTA	ALTAELVA	added NHS	21200011000		69.83	23.52	43	6187
6	NORWAY	LOSNA	LAGEN	added NHS	200145000		61.33	10.28	180	11210
6	NORWAY	MASI	ALTAELVA	added NHS	21200010000		69.42	23.64	272	5626
6	NORWAY	MJOENDALEN BRU	DRAMSELVA	added NHS	1200534000		59.75	10.01	20	0
6	NORWAY	POLMAK	TANA	agreed NHS	23400001000	6730500	70.07	28.06		14160
6	NORWAY	POLMAK NYE	TANA	added NHS	23400018000		70.07	28.02	20	14160
6	NORWAY	SKARNES	GLOMMA	added NHS	200122000		60.25	11.68	129.4	20300
6	NORWAY	SOLBERGFOSS	GLOMMA	added NHS	200605000		59.64	11.15	101	0
6	ROMANIA	CEATAL IZMAIL	DANUBE	agreed NHS		6742900	45.22	28.73	0.6	807000

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6	ROMANIA	ISACCEA	DANUBE	added NHS			45.17	28.29	470	805700
6	UNITED KINGDOM	BALLATHIE	TAY	added NHS	15006	6604610	56.51	-3.39		4587
6	UNITED KINGDOM	BLAIRSTONE	CLYDE	added NHS	84005		55.8	-4.07		1704
6	UNITED KINGDOM	COLWICK	TRENT	agreed NHS	28009	6605600	52.95	-1.08		7486
6	UNITED KINGDOM	KINGSTON	THAMES	agreed NHS	39001	6607650	51.41	-0.32		9948
6	UNITED KINGDOM	NORHAM	TWEED	agreed NHS	21009	6604750	55.72	-2.16		4390
6	UNITED KINGDOM	REDBROOK	WYE	added NHS	55023		51.8	-2.68		4010

Annex III: GTN-R stations remaining in the status of initial proposal, sorted by WMO region and country

(A detailed list of received metadata is available at http://gtn-r.bafg.de/servlet/is/9465/)

WMO-Region	GTNR_STN_COUNTRY	GTNR_STN_STATION	GTNR_STN_RIVER	CONFIRMATION	NATIONAL_ID	GRDC_NO	LAT_DD	LONG_DD	ALT_M	AREA_KM2
1	ANGOLA	UNKNOWN	CUANCA	proposed GRDC						
1	BOTSWANA	UNKNOWN	OKAVANGO	proposed GRDC						
1	CAMEROON	DEHANE	NYONG	proposed GRDC		1339100	3.57	10.12		26400
1	CAMEROON	EDEA	SANAGA	proposed GRDC		1338050	3.77	10.07		131520
1	CAMEROON	MAMFE	CROSS	proposed GRDC		1336500	5.75	9.32		6810
1	CAMEROON	NGOAZIK	NTEM	proposed GRDC		1340500	2.3	11.3		18100
1	CAMEROON	UNKNOWN	LAKE CHAD DRAINAGE CM	proposed GRDC						
1	CHAD	NDJAMENA(FORT LAMY)	CHARI	proposed GRDC		1537100	12.12	15.03		600000
1	CHAD	UNKNOWN	LAKE CHAD DRAINAGE TD	proposed GRDC						
1	CONGO DEM REP	KINSHASA	CONGO	proposed GRDC		1147010	-4.3	15.3		3475000
1	COTE D'IVOIRE	DAKPADOU	DAVO	proposed GRDC		1427600	5.26	-6.06		6600
1	COTE D'IVOIRE	MBASSO	COMOE	proposed GRDC		1428500	6.29	-3.49		69900
1	COTE D'IVOIRE	SOUBRE	SASSANDRA	proposed GRDC		1427500	5.76	-6.6		62000
1	COTE D'IVOIRE	TATE	CAVALLY	proposed GRDC		1425500	4.38	-7.59		28800
1	COTE D'IVOIRE	TIASSALE	BANDAMA	proposed GRDC		1426380	5.88	-4.75		95500
1	EGYPT	EL EKHSASE	NILE	proposed GRDC		1362100	29.7	31.28		2900000
1	GABON	IBANGA	NYANGA	proposed GRDC		1644100	-2.76	10.72		20000
1	GABON	LAMBARENE	OGOUE	proposed GRDC		1643100	-0.68	10.23		205000
1	GHANA	ALANDA	TANO	proposed GRDC		1530100	5.12	-2.75		15800
1	GHANA	DABOASI	PRA	proposed GRDC		1526300	5.1667	-1.6333		22714
1	GHANA	SENCHI(HALCROW)	VOLTA	proposed GRDC		1531700	6.2	0.1		394100
1	KENYA	GARISSA	TANA	proposed GRDC		1789300	-0.45	39.7		42220
1	KENYA	UNKNOWN	GALANA	proposed GRDC						
1	MADAGASCAR	BETOMBA	TSIRIBIHINA	proposed GRDC		1389230	-19.72	44.96		45000
1	MADAGASCAR	BEVOAY	MANGOKY	proposed GRDC		1389090	-21.83	43.87		53225
1	MALAWI	CHIROMO	SHIRE	proposed GRDC		1992900	-16.55	35.13		149500
1	MOROCCO	AZIB SOLTANE	SEBOU	proposed GRDC		1309700	34.28	-5.43		17250
1	MOZAMBIQUE	CHOBELA	INCOMATI	proposed GRDC		1897500	-25.02	32.73		37600
1	MOZAMBIQUE	CHOKWE	LIMPOPO	proposed GRDC		1896500	-24.5	33		342000
1	MOZAMBIQUE	ESTAQUINHA	BUZI	proposed GRDC		1894200	-19.95	34.15		26314
1	MOZAMBIQUE	MADUBULA	MAPUTO	proposed GRDC		1899100	-26.78	32.43		28500

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1	MOZAMBIQUE	MATUNDO-CAIS	ZAMBEZI	proposed GRDC		1891500	-16.15	33.58		940000
1	MOZAMBIQUE	UNKNOWN	LURIO	proposed GRDC						
1	MOZAMBIQUE	UNKNOWN	MESSALO	proposed GRDC						
1	MOZAMBIQUE	VILLAFRANCA DO SAVE	SAVE	proposed GRDC		1895500	-21.1	34.68		100885
1	NAMIBIA	UNKNOWN	CUNUERE	proposed GRDC						
1	NAMIBIA	UNKNOWN	LOWEN RIVER	proposed GRDC						
1	NIGER	BAGARA DIFFA	KOMADOUGOU YOBE	proposed GRDC		1237500	13.28	12.6		115000
1	NIGER	UNKNOWN	LAKE CHAD DRAINAGE NE	proposed GRDC						
1	NIGERIA	LOKOJA	NIGER RIVER	proposed GRDC		1834101	7.8	6.7667		-999
1	NIGERIA	UNKNOWN	LAKE CHAD DRAINAGE NG	proposed GRDC						
1	SENEGAL	DAGANA	SENEGAL	proposed GRDC		1812100	16.52	-15.5		268000
1	SENEGAL	GOULOUMBOU	GAMBIA	proposed GRDC		1813200	13.47	-13.73		42000
1	SENEGAL	SALTINHO AMONT	CORUBAL	proposed GRDC		1815020	11.56	-14.67		23840
1	SENEGAL	SONACO	GEBA	proposed GRDC		1814070	12.43	-14.5		7340
1	SOMALIA	AFGOI	SHEBELLE	proposed GRDC		1878100	2.17	45.09		278000
1	SOMALIA	LUGH GANANA	JUBA-SHIBELI	proposed GRDC		1880100	3.56	42.32		179520
1	SOMALIA	UNKNOWN	LACH DERA	proposed GRDC						
1	TANZANIA	DAR-ES-SALAM-MOROGORO ROAD BRIDGE	RUVU	proposed GRDC		1289450	-6.68	38.7		15190
1	TANZANIA	KOROGWE	PANGANI	proposed GRDC		1289200	-5.17	38.47		25110
1	TANZANIA	STIGLER	RUFIJI	proposed GRDC		1286900	-7.8	37.92		158200
1	TANZANIA	UNKNOWN	LUGENDA	proposed GRDC						
1	TANZANIA	UNKNOWN	RUVUMA	proposed GRDC						
2	BANGLADESH	BAHADURABAD	BRAHMAPUTRA	proposed GRDC		2651100	25.18	89.67		636130
2	CAMBODIA	STUNG TRENG	MEKONG	proposed GRDC		2569005	13.533	105.945		635000
2	INDIA	BARKOT BR.	BRAHMANI RIVER (BHAHMANI)	proposed GRDC		2854080	21	85		-999
2	INDIA	FARAKKA	GANGES	proposed GRDC		2846800	21.28	72.95		61575
2	INDIA	GARUDESHWAR	NARMADA	proposed GRDC		2853200	25	87.92		835000
2	INDIA	GRAND ANICUT	CAUVERY RIVER	proposed GRDC		2854800	10.83	78.83		74004
2	INDIA	KAIMUNDI	MAHANADI RIVER (MAHAHADI)	proposed GRDC		2855800	20.42	83.67		132090
2	INDIA	KATHORE	TAPTI RIVER	proposed GRDC		2853300	21.28	72.95		832418
2	INDIA	NELLORE	PENNER RIVER	proposed GRDC		2854500	14.45	79.98		53290
2	INDIA	POLAVARAM	GODAVARI	proposed GRDC		2856900	16.92	81.78		299320
2	INDIA	RHONDIA	DAMODAR RIVER	proposed GRDC		2853200	21.92	73.65		89345

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2	INDIA	SEVALIA	MAHI RIVER	proposed GRDC		2853150	22.3	73.03		33670
2	INDIA	VIJAYAWADA	KRISHNA	proposed GRDC		2854300	16.52	80.62		251355
2	IRAN	AHVAZ	KARUN	proposed GRDC		2423500	31.32	48.67		60769
2	IRAN	HAMIDIYEH	KARKHEH	proposed GRDC		2423450	31.47	48.42		45882
2	IRAQ	BAGHDAD	TIGRIS	proposed GRDC		2595700	33.3	44.38		134000
2	IRAQ	HINDIYA	EUPHRATES	proposed GRDC		2595400	32.72	44.27		274100
2	JAPAN	FUKAWA (TONE NORTH BRANCH)	TONE	proposed GRDC		2588551	35.85	140.14		12458
2	JAPAN	HIRAKATA	YODO	proposed GRDC		2588200	34.81	135.65		7281
2	JAPAN	INUYAMA	KISO	proposed GRDC		2588301	35.4	136.97		4683.8
2	JAPAN	ISHIKARI-OHASHI	ISHIKARI	proposed GRDC		2587100	43.12	141.55		12697
2	JAPAN	KASHIMA	TENRYU	proposed GRDC		2588320	34.85	137.81		4880
2	JAPAN	KAWAHIRA	GONO (GO)	proposed GRDC		2589200	35	132.29		3807
2	JAPAN	OJIYA	SHINANO, CHIKUMA	proposed GRDC		2589500	37.31	138.81		9719
2	JAPAN	TAKAYA	MOGAMI	proposed GRDC		2589700	38.76	140.07		6270.9
2	JAPAN	TOME	KITAKAMI	proposed GRDC		2588700	38.66	141.29		7869.4
2	KAZAKHSTAN	KAZALINSK	SYR DARYA	proposed GRDC		2916201	45.75	62.12		-999
2	KAZAKHSTAN	KUSHUM	URAL	proposed GRDC		2919200	50.85	51.28		190000
2	KOREA, REP	INDOGYO	HAN GANG (HAN RIVER)	proposed GRDC		2677100	37.52	126.97		25046
2	KOREA, REP	SAMNANGJIN	NAKTONG	proposed GRDC		2694510	35.4	128.85		22916
2	PAKISTAN	KOTRI	INDUS	proposed GRDC		2335950	25.37	68.37		61575
2	THAILAND	BAN WANG KHANAI	MAE KLONG	proposed GRDC		2964998	13.56	99.83		26449
2	THAILAND	WAT CHULA MANI (BAN KUM)	CHAO PHRAYA	proposed GRDC		2964128	14.4264	100.4864		-999
2	UZBEKISTAN	CHATLY	AMU DRAYA	proposed GRDC		2917100	42.28	59.7		450000
2	VIETNAM	NONG SON	THRAN (NR THU BON)	proposed GRDC		2371300	15.7167	108.0167		-999
2	VIETNAM	UNKNOWN	HONG (RED RIVER)	proposed GRDC						
2	VIETNAM	YEN THUONG	CA	proposed GRDC		2372102	18.8833	105.2833		-999
3	ARGENTINA	ACHUPALLAS	SALADO	proposed GRDC		3258200	-35.08	-60.12		29000
3	ARGENTINA	CHARLES FUHR	SANTA CRUZ	proposed GRDC		3276800	-50.27	-71.9		15550
3	ARGENTINA	LOS ALTARES	CHUBUT	proposed GRDC		3276200	-43.85	-68.5		
3	ARGENTINA	PICHI MAHUIDA	COLORADO (ARGENTINA)	proposed GRDC		3275750	-38.83	-64.83		223000
3	ARGENTINA	PRIMERA ANGOSTURA	NEGRO (ARGENTINA)	proposed GRDC		3275990	-40.43	-63.67		95000
3	ARGENTINA	TIMBUES	PARANA	proposed GRDC		3265601	-32.67	-60.71		2346000
3	BRAZIL	ALTAMIRA	XINGU	proposed GRDC		3630050	-3.2	-52.22		446570
3	BRAZIL	ALTO BONITO	RIO GURUPI	proposed GRDC		3650202	-1.83	-46.22		31850
3	BRAZIL	ARAPARI	RIO MAICURO	proposed GRDC		3630300	-1.75	-54.42		17072

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3	BRAZIL	BACABAL	RIO MEARIM	proposed GRDC		3650335	-4.22	-44.76		25500
3	BRAZIL	BADAJOS	RIO CAPIM	proposed GRDC		3650150	-2.52	-47.82		38178
3	BRAZIL	CAMPOS-PONTE MUNICIPAL	PARAIBA DO SUL	proposed GRDC		3652890	-21.75	-41.33		55083
3	BRAZIL	CANTANHEDE	RIO ITAPECURO	proposed GRDC		3650359	-3.63	-44.38		50800
3	BRAZIL	FAZENDA BELEM	RIO VAZA_BARRIS	proposed GRDC		3652050	-10.92	-37.37		15740
3	BRAZIL	FAZENDA PAQUIRA	RIO PARU DESTE	proposed GRDC		3631210	-0.42	-53.7		30945
3	BRAZIL	FORTALEZA	RIO TAPAJOS	proposed GRDC		3629150	-6.03	-57.6		358657
3	BRAZIL	IPORANGA (PCD)	RIO RIBEIRA DO IGUAPE	proposed GRDC		3653120	-24.59	-48.59		12450
3	BRAZIL	ITAPEBI	JEQUITINHONHA	proposed GRDC		3652455	-15.95	-39.52		67769
3	BRAZIL	JAMANXIM	RIO JAMANXIM	proposed GRDC		3629204	-6.08	-55.7		40400
3	BRAZIL	JEQUIE	RIO DE CONTAS	proposed GRDC		3652220	-13.88	-40.1		42245
3	BRAZIL	LINHARES	RIO DOCE	proposed GRDC		3652600	-19.41	-40.06		78456
3	BRAZIL	LUZILANDIA	RIO PARNAIBA	proposed GRDC		3650481	-3.45	-42.37		322823
3	BRAZIL	MASCOTE	RIO PRADO	proposed GRDC		3652320	-15.57	-39.28		30360
3	BRAZIL	NANUQUE	MUCURI	proposed GRDC		3652500	-17.83	-40.35		14174
3	BRAZIL	OBIDOS	AMAZON	proposed GRDC		3629000	-1.9	-55.5		4640300
3	BRAZIL	PASSO DO RASO	RIO JACUI	proposed GRDC		3653400	-29.97	-51.45		71454
3	BRAZIL	PEDRA DO CAVALO	RIO PARAGUACU	proposed GRDC		3652135	-12.6	-38.98		53866
3	BRAZIL	PEIXE GORDO	RIO JAGUARIBE	proposed GRDC		3650649	-5.22	-38.2		48200
3	BRAZIL	PINDARE MIRIM	RIO PINDARE	proposed GRDC		3650285	-3.66	-45.46		34300
3	BRAZIL	PONTE DA BATALHA	RIO PARAIBA	proposed GRDC		3650885	-7.13	-35.05		19244
3	BRAZIL	PORTO PLATON	RIO AGAGUARI	proposed GRDC		3631050	0.71	-51.44		23373
3	BRAZIL	SAO FRANCISCO	RIO JARI	proposed GRDC		3631100	-0.68	-52.55		51343
3	BRAZIL	SOBRAL	RIO ACARAU	proposed GRDC		3650525	-3.68	-40.35		11160
3	BRAZIL	TRAIPU	SAO FRANCISCO	proposed GRDC		3651900	-9.97	-36.98		2148
3	BRAZIL	TUCURUI	TOCANTINS	proposed GRDC		3649950	-3.76	-49.67		742300
3	BRAZIL	USINA ALTAMIRA	RIO ITAPICURO	proposed GRDC		3652039	-11.73	-37.82		35150
3	CHILE	COLONIA	BAKER	proposed GRDC		3181500	-47.35	-72.85		23736
3	CHILE	CORNECHE	RAPEL	proposed GRDC		3179250	-33.98	-71.68		13186
3	CHILE	DESEMBOCADURA	BIOBIO	proposed GRDC		3179500	-36.83	-73.07		24029
3	CHILE	EL ALGODON (ALGODONES)	HUASCO	proposed GRDC		3178900	-28.72	-70.52		7187
3	CHILE	PANAMERICANA	LIMARI	proposed GRDC		3178800	-30.63	-71.57		11343
3	CHILE	QUILLAGUA	LOA	proposed GRDC		3178100	-21.65	-69.55		-999
3	FRENCH GUIANA	MARIPA	OYAPOCK	proposed GRDC		3514800	3.82	-51.88		25120
3	GUYANA	KAMARIA FALLS	CUYUNI	proposed GRDC		3308400	6.43	-58.82		53400
3	GUYANA	PLANTAIN ISLAND	ESSEQUIBO	proposed GRDC		3308600	5.85	-58.58		66600

WMO-Region	GTNR_STN_COUNTRY	GTNR_STN_STATION	GTNR_STN_RIVER	CONFIRMATION	NATIONAL_ID	GRDC_NO	LAT_DD	LONG_DD	ALT_M	AREA_KM2
3	SURINAME	LANGA TABBETJE	MARONI	proposed GRDC		3412800	5	-54.4		63700
3	SURINAME	MAKSITA	COPPENAME	proposed GRDC		3411300	4.9	-56.12		12300
3	SURINAME	MATAWAY	CORANTIJN	proposed GRDC		3410500	5.8	-57.12		51600
3	URUGUAY	PALMAR	NEGRO (URUGUAY)	proposed GRDC		3469100	-33.12	-57.18		63000
3	URUGUAY	SALTO	URUGUAY	proposed GRDC		3469050	-31.38	-57.93		244000
3	VENEZUELA	PUENTE ANGOSTURA	ORINOCO	proposed GRDC		3206720	8.15	-63.6		836000
4	EL SALVADOR	SAN MARCOS	LEMPA	proposed GRDC		4664800	13.43	-88.7		18176
4	HONDURAS	UNKNOWN	RIO PATUCA	proposed GRDC						
4	HONDURAS	UNKNOWN	RIO ULUA	proposed GRDC						
4	MEXICO	BOCA DEL CERRO	RIO USUMACINTA	proposed GRDC		4362600	17.4333	-91.4833		47697
4	MEXICO	COLIMAN	RIO ARMERIA	proposed GRDC		4356280	18.9417	-103.925		9744
4	MEXICO	EL CAPOMAL	RIO SANTIAGO	proposed GRDC		4356100	21.825	-105.115		128943
4	MEXICO	EL NOVILLO I	RIO YAQUI	proposed GRDC		4353300	28.93	-109.63		57908
4	MEXICO	LAS ADJUNTAS	RIO PANUCO	proposed GRDC		4358300	21.9833	-98.5667		61063
4	MEXICO	PAPALOAPAN	RIO PAPALOAPAN	proposed GRDC		4359220	18.17	-96.08		21419
4	MEXICO	PASO DE LA REYNA	RIO VERDE (RIO ATOYAK)	proposed GRDC		4356700	16.275	-97.5917		17617
4	MEXICO	REFORMA	RIO GRIJALVA (RIO MEZCALAPA)	proposed GRDC		4362201	17.9583	-93.1833		37702
4	MEXICO	SAN MIGUEL ZAPOTITLAN	RIO FUERTE	proposed GRDC		4355300	25.9542	-109.046		34247
4	MEXICO	SAN PEDRO	RIO SAN PEDRO	proposed GRDC		4356080	21.9667	-105.15		25800
4	MEXICO	UNKNOWN	RIO CONCEPTION	proposed GRDC						
4	NICARAGUA	EL CASTILLO	SAN JUAN	proposed GRDC		4773800	11.02	-84.42		28600
4	NICARAGUA	SAN PEDRO DEL NORTE	GRANDE DE MATAGALPA	proposed GRDC		4772300	13.05	-84.72		14646
4	NICARAGUA	UNKNOWN	RIO COCO	proposed GRDC						
5	AUSTRALIA	COOLENAR POOL	DE GREY RIVER	proposed GRDC		5607500	-20.311	119.249		49600
5	AUSTRALIA	COOLIBAH HOMESTEAD	VICTORIA RIVER	proposed GRDC		5708110	-15.533	130.95		44900
5	AUSTRALIA	COOLIBAH POCKET	ORD	proposed GRDC		5608090	-16.134	128.7396		46100
5	AUSTRALIA	DARRADUP	BLACKWOOD RIVER	proposed GRDC		5606100	-34.073	115.6181		20500
5	AUSTRALIA	EMU SPRINGS	MURCHISON RIVER	proposed GRDC		5607100	-27.855	114.5459		82300
5	AUSTRALIA	FITZROY CROSSING	FITZROY RIVER	proposed GRDC		5608024	-18.206	125.5805		45300
5	AUSTRALIA	HOME HILL	BURDEKIN	proposed GRDC		5101201	-19.644	147.3958		129760
5	AUSTRALIA	JIMBEGNYINOO POOL	FORTESCUE RIVER	proposed GRDC		5607450	-21.333	116.1556		48900
5	AUSTRALIA	KOOLATAH	MITCHELL RIVER (N.AU)	proposed GRDC		5109200	-15.948	142.3767		45872
5	AUSTRALIA	M.I.M PUMP	MACARTHUR RIVER	proposed GRDC		5709110	-16.452	136.0852		10400
5	AUSTRALIA	MOUNT NANCAR	DALY	proposed GRDC		5708145	-13.833	130.7333		47000
5	AUSTRALIA	NANUTARRA	ASHBURTON RIVER	proposed GRDC		5607400	-22.544	115.4994		70200

WMO-Region	GTNR_STN_COUNTRY	GTNR_STN_STATION	GTNR_STN_RIVER	CONFIRMATION	NATIONAL_ID	GRDC_NO	LAT_DD	LONG_DD	ALT_M	AREA_KM2
5	AUSTRALIA	NETTOPUS POOL	DURACK RIVER	proposed GRDC		5608400	-16.317	127.1787		4150
5	AUSTRALIA	NUNE MILE BRIDGE	GASCOYNE RIVER	proposed GRDC		5607200	-24.828	113.7691		73400
5	AUSTRALIA	OVERLAND CORNER (417.5 KM)	MURRAY	proposed GRDC		5404270	-34.18	140.274		-999
5	AUSTRALIA	RED ROCK	ROPER RIVER	proposed GRDC		5709100	-14.7	134.4167		47400
5	AUSTRALIA	ROCKFIELDS	GILBERT RIVER	proposed GRDC		5109170	-18.203	142.8747		11800
5	AUSTRALIA	SOLEA FALLS (HORSESHOE)	DRYSDALE	proposed GRDC		5608500	-14.66	126.99		14000
5	AUSTRALIA	THE GAP	FITZROY	proposed GRDC		5101301	-23.088	150.1078		135757
5	AUSTRALIA	U/S MACQUARIE RIVER (PERTH)	SOUTH ESK RIVER	proposed GRDC		5803180	-41.599	147.2028		3278
5	AUSTRALIA	UNKNOWN	FLINDERS RIVER	proposed GRDC						
5	AUSTRALIA	UNKNOWN	LEICHHARDT RIVER	proposed GRDC						
5	INDONESIA	BOJONEGORO	SOLO (BENGAWAN SOLO)	proposed GRDC		5141200	-7.1	111.83		12804
5	INDONESIA	JABON	BRANTAS	proposed GRDC		5141100	-7.48	112.2		8650
5	INDONESIA	UNKNOWN	BATAN KUANTAN	proposed GRDC						
5	INDONESIA	UNKNOWN	BATANG HARI	proposed GRDC						
5	INDONESIA	UNKNOWN	EILANDEN	proposed GRDC						
5	INDONESIA	UNKNOWN	LORENTZ	proposed GRDC						
5	INDONESIA	UNKNOWN	MAMBERANO	proposed GRDC						
5	INDONESIA	UNKNOWN	SUNGAI DIGAL	proposed GRDC						
5	INDONESIA	UNKNOWN	SUNGAI KAJAN	proposed GRDC						
5	INDONESIA	UNKNOWN	SUNGAI MAHAKAM	proposed GRDC						
5	INDONESIA	UNKNOWN	SUNGAI PUNGGUR BESAR	proposed GRDC						
5	MALAYSIA	BALAT	KINABATANGAN	proposed GRDC		5231700	5.3	117.59		10800
5	MALAYSIA	GUILLEMARD BRIDGE	KELANTAN	proposed GRDC		5223100	5.77	102.15		11900
5	MALAYSIA	KAPIT WHARF	RAJANG	proposed GRDC		5230300	2.01	112.94		34053
5	MALAYSIA	TEMERLOH	PAHANG	proposed GRDC		5224500	3.45	102.43		19000
5	NEW ZEALAND	BALCLUTHA	CLUTHA	proposed GRDC		5868100	-46.239	169.7478		20582
5	NEW ZEALAND	NGARUAWAHIA	WAIKATO RIVER	proposed GRDC		5865300	-37.653	175.1456		11395
6	AZERBAIJAN	SURRA	KURA	proposed GRDC		6990700	40.12	48.67		178000
6	DENMARK	AHLERGAARDE	SKJERN A	proposed GRDC		6934100	55.95	8.72		1040
6	DENMARK	TVILUMBRO	GUDENA	proposed GRDC		6934250	56.24	9.67		1290
6	ESTONIA	NARVA (HEP)	NARVA	proposed GRDC		6972350	59.35	28.25		56000
6	FINLAND	ANJALA	KYMIJOKI	proposed GRDC		6855200	60.7	25.53		36275
6	FINLAND	ISOHAARA (NEAR THE MOUTH)	KEMIJOKI	proposed GRDC		6854700	65.78	24.55		50686

WMO-Region	GTNR_STN_COUNTRY	GTNR_STN_STATION	GTNR_STN_RIVER	CONFIRMATION	NATIONAL_ID	GRDC_NO	LAT_DD	LONG_DD	ALT_M	AREA_KM2
6	FINLAND	KALSINKOSI	KOKEMAENJOKI	proposed GRDC		6854100	61.35	22.12		26025
6	FINLAND	MERISKOSKI (NEAR THE MOUTH)	OULOJOKI	proposed GRDC		6854500	65.02	25.52		22841
6	FINLAND	RAASAKKA (NEAR THE MOUTH)	IIJOKI	proposed GRDC		6854600	65.32	25.43		14191
6	FINLAND	TAINIONKOSKI	VOUKSI	proposed GRDC		6855400	61.22	28.78		61061
6	FRANCE	BEAUCAIRE	RHONE	proposed GRDC		6139100	43.92	4.67		95590
6	FRANCE	MAS-D'AGENAIS	GARONNE	proposed GRDC		6125100	44.42	0.23		52000
6	FRANCE	MONTJEAN	LOIRE	proposed GRDC		6123100	47.38	-0.83		110000
6	FRANCE	POSES	SEINE	proposed GRDC		6122100	49.3	1.25		65000
6	ITALY	PONTELAGOSCURO	PO	proposed GRDC		6348800	44.88	11.65		70091
6	LITHUANIA	SMALININKAI	NEMUNAS	proposed GRDC		6974150	55.0667	22.6		81200
6	POLAND	GOZDOWICE	ODER RIVER	proposed GRDC		6457010	52.7667	14.3167		109729
6	POLAND	TCZEW	WISLA	proposed GRDC		6458010	54.1	18.82		194376
6	PORTUGAL	ALMOUROL	TEJO	proposed GRDC		6113050	39.47	-8.37		67490
6	PORTUGAL	PULO DO LOBO	GUADIANA	proposed GRDC		6116200	37.82	-7.63		60883
6	PORTUGAL	REGUA	DOURO	proposed GRDC		6112090	41.15	-7.68		91491
6	RUSSIA	3 KM UP UST'YA UT.	ANADYR	proposed GRDC		2901202	64.49	173.38		156000
6	RUSSIA	7.5KM D/S OF MOUTH OF RIVER PUR	OLENEK	proposed GRDC		2999910	72.12	123.22		198000
6	RUSSIA	ANDRUSHKINO	ALAZEYA	proposed GRDC		2998450	69.17	154.5		29000
6	RUSSIA	BELOMORSK	NISHNI VYG (SOROKA)	proposed GRDC		6972130	64.52	34.7		27000
6	RUSSIA	BOLSHIE SCHEKI	KAMCHATKA	proposed GRDC		2902850	56.27	161.67		51600
6	RUSSIA	IGARKA	YENISEI	proposed GRDC		2909150	67.48	86.5		2440000
6	RUSSIA	KHATANGA	KHATANGA	proposed GRDC		2999850	71.98	102.45		275000
6	RUSSIA	KNYAZHEGUBSKOYE GES	KOVDA	proposed GRDC		6972860	66.87	32.38		25900
6	RUSSIA	KOLYMSKAYA	KOLYMA	proposed GRDC		2998510	68.73	158.72		526000
6	RUSSIA	KOMSOMOLSK	AMUR	proposed GRDC		2906900	50.63	137.12		1730000
6	RUSSIA	KONSTANTINOVO	BOL. ANYUY (TRIB. KOLYMA)	proposed GRDC		2998720	68.15	161.17		49600
6	RUSSIA	KYUSYUR (KUSUR)	LENA	proposed GRDC		2903420	70.7	127.65		2430000
6	RUSSIA	MALONISOGORSKAYA	MEZEN	proposed GRDC		6970500	65	45.62		56400
6	RUSSIA	NADYM	NADYM	proposed GRDC		2999200	65.62	72.67		48000
6	RUSSIA	NAMU	OMOLOY	proposed GRDC		2998150	69.51	132.07		10800
6	RUSSIA	NOVOSARATOVKA	NEVA	proposed GRDC		6972430	59.8	30.72		281000
6	RUSSIA	OKSINO	PECHORA	proposed GRDC		6970700	67.63	52.18		312000
6	RUSSIA	OSTROVNOJE	ANYUY (TRIB. KOLYMA)	proposed GRDC		2998702	68.1	164.17		30000

WMO-Region	GTNR_STN_COUNTRY	GTNR_STN_STATION	GTNR_STN_RIVER	CONFIRMATION	NATIONAL_ID	GRDC_NO	LAT_DD	LONG_DD	ALT_M	AREA_KM2
6	RUSSIA	PALYAVAAM	PALYAVAAM	proposed GRDC		2998800	68.53	174.15		6810
6	RUSSIA	PODUZHEMYE	KEMI	proposed GRDC		6972800	64.9	34.3		27900
6	RUSSIA	PONOY	PONOY	proposed GRDC		6971450	67.09	41.13		15200
6	RUSSIA	POROG	ONEGA	proposed GRDC		6970100	63.82	38.47		55770
6	RUSSIA	RAZDORSKAYA	DON	proposed GRDC		6978250	47.5	40.67		378000
6	RUSSIA	SALEKHARD	OB	proposed GRDC		2912600	66.57	66.53		2949998
6	RUSSIA	SAMBURG	PUR	proposed GRDC		2999500	67	78.22		95100
6	RUSSIA	SASKYLAKH	ANABAR	proposed GRDC		2999150	71.98	114.057		78800
6	RUSSIA	SIDOROVSK	TAZ	proposed GRDC		2999250	66.6	82.28		100000
6	RUSSIA	TIKHOVSKY	KUBAN	proposed GRDC		6983350	45.15	38.32		48100
6	RUSSIA	UBILEYNAYA	YANA	proposed GRDC		2998110	70.75	136.08		224000
6	RUSSIA	UNKNOWN	POPIGAY	proposed GRDC						
6	RUSSIA	UNKNOWN	PYASIMA	proposed GRDC						
6	RUSSIA	UST-PINEGA	NORTHERN DVINA (SEVERNAYA DVINA)	proposed GRDC		6970250	64.1	42.17		348000
6	RUSSIA	VARZUGA	VARZUGA	proposed GRDC		6971600	66.4	36.63		7940
6	RUSSIA	VERKHNETULOMSKIY GES	TULOMA	proposed GRDC		6971130	68.6	31.75		17500
6	RUSSIA	VOLGOGRAD POWER PLANT	VOLGA	proposed GRDC		6977100	48.77	44.72		1360000
6	RUSSIA	VORONTSOVO	INDIGIRKA	proposed GRDC		2998400	69.58	147.35		305000
6	SPAIN	ALCALA DEL RIO	GUADALQUIVIR	proposed GRDC		6217100	37.52	-5.98		46995
6	SPAIN	TORTOSA	EBRO	proposed GRDC		6226800	40.82	0.52		84230
6	SWEDEN	BODENS KRV (+ VATTENVERK, TRANGFORS)	LULEAELVEN	proposed GRDC		6233750	65.81	21.67		24924
6	SWEDEN	KALLIO	MUONIO	proposed GRDC		6233900	67.23	23.58		14408.5
6	SWEDEN	RAEKTFORS	KALIXAELVEN	proposed GRDC		6233850	66.17	22.82		23103
6	SWEDEN	SOLLEFTEAE KRV	ANGERMANAELVEN	proposed GRDC		6233650	63.17	17.27		30638
6	SWEDEN	VAENERSBORG - VARGOENS KRV	VAENERN_GOETA (GOETA AELV)	proposed GRDC		6229500	58.36	12.37		46885.5
6	TURKEY	BOTBASI	SAKARYA	proposed GRDC		6688150	40.97	30.52		55322
6	TURKEY	INOEZUE	KIZILIRMAK	proposed GRDC		6688600	41.38	35.8		75121
6	UKRAINE	ALEKSANDRIYSKAYA	KUMA	proposed GRDC		6984300	44.18	43.31		3630
6	UKRAINE	DNEPR POWER PLANT	DNIEPR	proposed GRDC		6980800	47.92	35.15		463000

Annex IV: The GRDC Near Real-Time Data Format Version 3.0

The complete document including an example file can be downloaded at http://grdc.bafg.de/?6678

The following information is necessary for creating or reading files in the GRDC real-time data file format. The columns inside the data file are separated by semicolon characters ";". They contain the values described in the following. The values are numbered according to their position in the data records.
The values are always given in SI-units (metres, cubic metres per second). The dot "." is used as decimal point. (i.e. "1.8") There must not occur separator chars for big numbers. Empty columns (i. e. ;;) are allowed, if the field is not mandatory. Empty columns with logical values will be treated as false and empty columns with numeric values will be treated as missing values. We propose to use unique values like -999 as (optional) markers for missing numeric values. Measured zero values have to be given as 0.
Every file may start with a fixed header, containing information on the contents of the file. The lines of the header are preceded by the crosshatch "#" character. This character may **only** be used in the header of the file. Header data is neither required nor used by the ETN-R project during import, but may be exported in order to make the data files more intelligible for humans. The header lines have a maximum length of 80 characters. Within the header it is allowed to include any textual information like i.e. about the origin of the included datasets (Provider identifier) and timestamp of the file creation. Any information given in the header are **not** used and **not** stored in the ETN-R database.
Starting with the fifth position, flags describing various properties of the data set are given. These are always logical values encoded as integers (0 for false or 1 for true) where true means that the respective condition is met and false that it is not met.

1. ***National station identifier*** (case insensitive string). (**mandatory**)
2. ***Timestamp of the measurement*** (Format is: YYYY-MM-DD hh:mm:ss) which follows the ISO 8601 and EN 28601 standard. The time must be given as Universal Time Coordinated (UTC) +0. The calculation is up to the provider, who has to consider local daylight saving time also.

   YYYY stands for the 4 digit year (i.e. 2006). MM stands for the two digit month may be from 01 up to 12 (i. e. 06 for June). The part hh:mm:ss stands for the time of the measurement with hh for hours in the 24 hours scheme (00 up to 23), mm for the minutes (00 up to 59) and ss for the seconds (00 up to 59). (**mandatory**)
3. ***Water level*** (number, metres)
4. ***Discharge*** (number, cubic metres per second)
5. ***Missing value*** (logical, 1= is missing / 0= is not missing) (**mandatory**)
   a. Water level
   b. Discharge
6. ***Is value measured*** (logical) (1= measured value/ 0= estimated value) (**mandatory**)
   a. Water level
   b. Discharge
7. ***Is data reliable*** (logical, 1= is reliable / 0= is not reliable) (**mandatory**)
   a. Water level
   b. Discharge
8. **Aggregation** (**mandatory**)
   a. **interval** (number, 0..n, if this is equal to 0, no aggregation took place) (in minutes)

b. **offset** (number, negative or positive offset in minutes of the timestamp to the end of the averaging interval) (**offset can be omitted if interval is 0**)

Definition: Value is 0 if the timestamp of this data set marks the end of the aggregation interval and equal to value 8.a, if the timestamp marks the start of the aggregation interval. It is 0.5 * value 8.a if the timestamp marks the centre of the aggregation interval.

9. ***Is ice cover*** (logical)
10. ***Is ice jam*** (logical)
11. ***Is weedage*** (logical)
12. Is influenced by backwater (logical)

Annex V: Supplementary information (metadata) for the GTN-R

Supplementary information as requested in the Information Package of April 2005

- For each river gauging station that is part of the Global Terrestrial Network – Rivers (GTN-R) and therefore submits data to the GRDC, the latter requires to receive the following information (metadata) for each station, once initially and every time thereafter it changes.

  Metadata of the gauging station, describing its characteristics, especially
  - National Station ID
  - Station Name
  - River Name
  - Country Name
  - Latitude in degrees
  - Longitude in degrees
  - Altitude in m above sea level
  - Catchment area in km²
  - Full postal address of the organisation handling and delivering the data
  - Name, telephone, fax and email address of a focal point for the data.

- In order to initiate and maintain an automated electronic transfer of NRT data from your data server to the GRDC, the following information for each station is necessary, once initially, and thereafter every time it changes:

  Metadata of the electronic online data source that contains station data, i.e.,
  - Server location and filename
  - User-ID, if required
  - Password, if required
  - Frequency, time and time zone of data updates (e.g., daily, 09:30, UTC+8h)
  - Full postal address of the organisation handling and maintaining the electronic online provision of data
  - Name, telephone, fax and email address of a focal point for the electronic online provision of data.

- In case water level data are provided, GRDC additionally requires a valid rating curve in terms of a function, look-up table or graphic to allow the automated transformation of water levels into discharge.

- Allowing GRDC to determine long-term statistical characteristics and thus put the provided instantaneous/daily values into perspective, GRDC highly appreciates additional information on the longest available record of historic daily discharge values.

The full information package can be downloaded from the GTN-r website at http://gtn-r.bafg.de/servlet/is/9419/.

Annex VI: Status of contributions to the ETN-R by country

	WP	Agreement	Metadata	Station selection	NRT data	hist. data
ALBANIA	2	yes	partly			
AUSTRIA	1	yes	partly			
BELARUS	2	no contact/ support pending				
BELGIUM	2	negotiation	yes	yes		
BOSNIA-HERZEGOVINA	1	no contact/ support pending				
BULGARIA	1	yes	partly	yes		
CROATIA	1	yes				
CZECH REPUBLIC	1	yes		yes		
ESTONIA	2	yes				
FINLAND	2	yes				
FRANCE	2	yes	partly	yes		
GERMANY - Water & Shipping Adm.	1	yes	partly	yes	yes	
GERMANY - BW	1	no contact/ support pending				
GERMANY - BY	1	yes				
GERMANY - BR	1	yes				
GERMANY - HE	1	yes	yes	yes	yes	
GERMANY - NI	1	no contact/ support pending		yes		
GERMANY - NW	1	yes	partly	yes		
GERMANY - RP	1	yes	yes	yes	yes	
GERMANY - SL	1	yes	yes	yes		
GERMANY - SN	1	yes	yes	yes	yes	
GERMANY - ST	1	yes				
GERMANY - TH	1	yes				
GREECE	2	discussion				
HUNGARY	1	yes	yes	yes		
ITALY	2	discussion				
LATVIA	2	yes				
LITHUANIA	2	no contact/ support pending				
LUXEMBOURG	1	yes	yes	yes		
MACEDONIA	2	yes				
MOLDOVA	2	yes				
MONTENEGRO	1	yes				
NETHERLANDS	1	yes	yes	yes		
NORWAY	2	yes	partly	yes		
POLAND	2	discussion	partly			
PORTUGAL	2	discussion	yes			
ROMANIA	1	yes				
RUSSIA	2	yes; additional contacts needed				
SERBIA	1	discussion	yes	yes		

	WP	Agreement	Metadata	Station selection	NRT data	hist. data
SLOVAKIA	1	yes	yes			
SLOVENIA	1	yes	yes	yes	yes	yes
SPAIN	2	agreement	yes			
SWEDEN	2	yes	yes	yes		
SWITZERLAND	1	yes				
TURKEY	2	discussion				
UKRAINE	2	discussion				
UNITED KINGDOM	2	discussion				

Annex VII: Identified and established contacts of the ETN-R

Area	Institution	POC	Contact identified	Contact established
ALBANIA	Hydrometeorological Institute	Mitat Sanxhaku	+	+
AUSTRIA	Federal Ministry of Agriculture, Forestry, Environment and Water Management Hydrographisches Zentralbüro	Reinhold Godina	+	+
BELARUS	State Committee for Hydrometeorology Гидрометцентр Республики Беларусь	Y. M. Pokoumeiko	+	-
BELGIUM Flanders	Hydrological Information Centre Administratie Waterwegen en Zeewezen Hydrologisch Informatie Centrum (HIC)	Hans Vereecken	+	+
BELGIUM Flanders	Flemish Environment Agency Vlaamse Milieumaatschappij	Kris Cauwenberghs	+	+
BELGIUM Walloon	Direction Générale des Ressources Naturelles et de l'Environnement, Walloon Region	Didier De Thysebaert	+	+
BELGIUM Walloon	La Direction Générale des Voies hydrauliques	Jacques Laurent	+	+
BOSNIA AND HERZEGOVINA	Hidrometeorological and seismological service Bosnia and Herzegovina Republic of Srpska	Drago Trkulja	+	-
BOSNIA AND HERZEGOVINA	Federal Meteorological Institute Meteoroloski zavod Bosne i Hercegovine	Nino Rimac	+	+
BULGARIA	National Institute of Meteorology and Hydrology	Dobri Dimitrov	+	+
CROATIA	Meteorological and Hydrological Service Republic of Croatia	Borivoj Terek	+	+
CZECH REP	Czech Hydrometeorological Institute (Praha) Český hydrometeorologický ústav (Praha)	Jan Kubát	+	+
ESTONIA	Estonian Meteorological and Hydrological Institute Eesti Meteoroloogia Ja Hüdroloogia Instituut	Anna Põrh	+	+
FINLAND	Finnish Environment Institute Hydrological Services Division Suomen ympäristökeskus	Matti Ekholm	+	+
FRANCE	Ministère de l'Ecologie et du Développement Durable La Direction de l'Eau Service Central d'Hydrométéorologie et d'Appui à la Prévision des Inondations	Isabelle Leleu	+	+
GERMANY	Wasser- und Schifffahrtsverwaltung	Wilfried Wiechmann	+	+
GERMANY Baden-Wurttemberg	Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg	Werner Schulz	+	+

Area	Institution	POC	Contact identified	Contact established
GERMANY Bayern	Bayerisches Landesamt für Umwelt Abteilung 8, Referat 88	Alfons Vogelbacher	+	+
GERMANY Berlin	Senatsverwaltung für Stadtentwicklung	Wolfgang Bergfelder	+	+
GERMANY Brandenburg	Landesumweltamt Brandenburg	Jens Martin	+	+
GERMANY Hamburg	Hamburg Port Authority	Hans P. Dücker	+	-
GERMANY Hessen	Hessisches Landesamt für Umwelt und Geologie	Gerhard Brahmer	+	+
GERMANY Niedersachsen	Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz	Stephan-Robert Heinrich	+	-
GERMANY Nordrhein-Westfalen	Landesumweltamt Nordrhein-Westfalen	Bernd Mehlig	+	+
GERMANY Rheinland-Pfalz	Landesamt für Umwelt, Wasserwirtschaft und Gewerbeaufsicht Rheinland-Pfalz	Norbert Demuth	+	+
GERMANY Saarland	Landesamt für Umwelt- und Arbeitsschutz	Carmen Fey	+	+
GERMANY Sachsen	Sächsisches Landesamt für Umwelt und Geologie	Petra Walther	+	+
GERMANY Sachsen-Anhalt	Landesbetrieb für Hochwasserschutz und Wasserwirtschaft Sachsen-Anhalt	Frank Goreczka	+	+
GERMANY Schleswig-Holstein	Landesamt für Natur und Umwelt	Uta Jesussek	+	+
GERMANY Thüringen	Thüringer Landesanstalt für Umwelt und Geologie	Lutz Förster	+	+
GREECE	Central Water Agency	Eleimon Tiligadas	+	+
HUNGARY	Environmental Protection and Water Management Research Institute	Gábor Bálint	+	+
ITALY	Italian Hydrological and Ocenographic Service Agenzia per la Protezione dell'Ambiente e per i Servizi Tecnici	Martina Bussettini	+	+
ITALY Emilia-Romagna	Agenzia Regionale Prevenzione e Ambiente dell'Emilia Romagna Servizio Idro Meteo	Stefano Tibaldi	+	+
ITALY Lombardia	Agenzia Regionale Prevenzione e Ambiente Lombardia	Roberto Serra	+	+
ITALY Piemonte	Agenzia Regionale Prevenzione e Ambiente Piemonte	Vincenzo Coccolo	+	+
ITALY Valle d'Aosta	Regione Autonoma Valle d'Aosta Direzione Tutela del Territorio	The Director	+	-
ITALY Po basin	Agenzia Interregionale per il fiume Po	The Director	+	-
ITALY Po basin	Autorità di bacino del fiume Po	Michele Presbitero	+	-
LATVIA	Latvian Hydrometeorological Agency Latvijas Vides, ģeoloģijas un meteoroloģijas aģentūra	Anda Bakute	+	+

Area	Institution	POC	Contact identified	Contact established
LUXEMBOURG	Centre de Recherche Public - Gabriel Lippmann	Laurent Pfister	+	+
LUXEMBOURG	Administration de la gestion de l'eau	Claude Ripp	+	+
MACEDONIA	Hydrometeorological Service	Vasko Stojov	+	+
MOLDOVA	State Hydrometeorological Service of Moldova Serviciului Hidrometeorologic de Stat	Liudmila Serenco	+	+
MONTENEGRO	Hydrometeorological Institute of Montenegro Hidrometeoroloski zavod Crne Gore	Darko Novaković	+	+
NETHERLANDS	Institute for Inland Water Management and Wastewater Treatment Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling	Eric Sprokkereef	+	+
NORWAY	Norwegian Water Resources and Energy Administration Norges vassdrags- og energidirektorat	Svein Taksdal	+	+
POLAND Gdynia Branch	Institute of Meteorology and Water Management, Gdynia Branch Instytut Meteorologii i Gospodarki Wodnej, Oddział Morski w Gdyni	The Director	+	-
POLAND Katowice Branch	Institute of Meteorology and Water Management, Katowice Branch Instytut Meteorologii i Gospodarki Wodnej, Oddział Morski w Katowice	The Director	+	-
POLAND Krakow Branch	Institute of Meteorology and Water Management, Krakow Branch Instytut Meteorologii i Gospodarki Wodnej, Oddział w Krakowie	The Director	+	-
POLAND Poznan Branch	Institute of Meteorology and Water Management, Poznan Branch Instytut Meteorologii i Gospodarki Wodnej, Oddział w Poznaniu	Malgorzata Kepinska-Kasprzak	+	+
POLAND Wroclaw Branch	Institute of Meteorology and Water Management, Wroclaw Branch Instytut Meteorologii i Gospodarki Wodnej, Oddział we Wrocławiu	Lezsek Jelonek	+	+
POLAND	Institute of Meteorology and Water Management Instytut Meteorologii i Gospodarki Wodnej	Bogdan Ozga-Zielinski	+	+
PORTUGAL	Instituto da Agua	Cláudia Brandão	+	+
ROMANIA	National Institute for Hydrology and Water Management Administratia Nationale de Meteorologie Institutul National de Hidrologie si Gospodarirea a Apelor	Ionel Ghinescu	+	+
RUSSIA	Russian Federal Service for Hydrometeorology and Environmental Monitoring	Alexander I. Bedritsky	+	-

Area	Institution	POC	Contact identified	Contact established
RUSSIA	Hydrometeorological Centre of Russia	Sergey Borsch	+	+
SERBIA	Republic Hydrometeorological Service of Serbia Republički Hidrometeoroloski Zavod Srbije	Samir Ćatović	+	+
SLOVAKIA	Slovak Hydrometeorological Institute Slovenský hydrometeorologický ústa	Jana Poórová	+	+
SLOVENIA	Ministry of Environment and Physical Planning Environmental Agency of Slovenia Agencija za okolje	Mojca Susnik	+	+
SPAIN	Direccion General de Obras Hidráulicas y Calidad de las Aguas	Miguel Francés	+	+
SPAIN Duero	Confederación Hidrográfica del Duero	Pedro Matía	+	+
SPAIN Ebro	Confederación Hidrográfica del Ebro (ES)	José Luis Alonso Gajon	+	+
SPAIN Guadiana	Confederación Hidrográfica del Guadiana	Francisco Barbancho	+	+
SPAIN Tajo	CONFEDERACIÓN HIDROGRÁFICA DEL TAJO	Luis Pérez	+	+
SWEDEN	Swedish Meteorological and Hydrological Institute Sveriges meteorologiska och hydrologiska institut	Håkan Sanner	+	+
SWITZERLAND	Bundesamt für Umwelt	Manfred Spreafico	+	+
TURKEY	Devlet Meteoroloji İşleri Genel Müdürlüğü Directory of State Hydraulic Works	Ziyaettin Durmaz	+	+
UKRAINE	Ukrainian hydrometeorological center	Viktoriya Boyko	+	+
UNITED KINGDOM	Environment Agency England and Wales	Craig Elliot	+	+

Annex VIII: Status of contributions to ETN-R and to GTN-R (European countries) as of July 2007

Country	ETN-R						GTN-R (European countries)					
	Relevance	Agreement	Metadata	Station selection	NRT data	HIST. data	Relevance	Agreement	Metadata	Station selection	NRT data	HIST. data
ALBANIA	+	yes	partly				0					
AUSTRIA	+	yes	partly				0					
BELARUS	+	no contact/ support pending					0					
BELGIUM	+	negotiation	yes	yes			0					
BOSNIA-HERZEGOVINA	+	no contact/ support pending					0					
BULGARIA	+	yes	partly	yes			0					
CROATIA	+	yes					0					
CZECH REPUBLIC	+	yes		yes			0					
DENMARK	0						+	no contact				
ESTONIA	+	yes					0					
FINLAND	+	yes					+	no contact				
FRANCE	+	yes	partly	yes			+	no contact				
GERMANY - Water & Shipping Adm.	+	yes	partly	yes	yes		+	yes	yes	yes		yes
GERMANY - BW	+	no contact/ support pending					0					
GERMANY - BY	+	yes					0					
GERMANY - BR	+	yes					0					
GERMANY - HE	+	yes	yes	yes	yes		0					
GERMANY - NI	+	no contact/ support pending		yes			0					

Country	ETN-R						GTN-R (European countries)					
	Relevance	Agreement	Metadata	Station selection	NRT data	HIST. data	Relevance	Agreement	Metadata	Station selection	NRT data	HIST. data
GERMANY - NW	+	yes	partly	yes			0					
GERMANY - RP	+	yes	yes	yes	yes		0					
GERMANY - SL	+	yes	yes	yes			0					
GERMANY - SN	+	yes	yes	yes	yes		0					
GERMANY - ST	+	yes					0					
GERMANY - TH	+	yes					0					
GREECE	+	discussion					0					
HUNGARY	+	yes	yes	yes			0					
ICELAND	0						+	yes	yes	yes	yes	
ITALY	+	discussion					+	no contact				
LATVIA	+	yes					+	yes	yes	yes		
LITHUANIA	+	no contact/ support pending					+	no contact				
LUXEMBOURG	+	yes	yes	yes			0					
MACEDONIA	+	yes					0					
MOLDOVA	+	yes					+	no contact				
MONTENEGRO	+	yes					0					
NETHERLANDS	+	yes	yes	yes			+	yes	yes	yes		yes
NORWAY	+	yes	partly	yes	yes		+	yes	yes	yes	yes	yes
POLAND	+	discussion	partly				+	no contact				
PORTUGAL	+	discussion	yes				+	no contact				
ROMANIA	+	yes					+	yes	yes	yes	yes	yes
RUSSIA	+	yes; additional contacts needed					+	no contact				
SERBIA	+	discussion	yes	yes			0					
SLOVAKIA	+	yes	yes				0					

Country	ETN-R						GTN-R (European countries)					
	Relevance	Agreement	Metadata	Station selection	NRT data	HIST. data	Relevance	Agreement	Metadata	Station selection	NRT data	HIST. data
SLOVENIA	+	yes	yes	yes	yes	yes	0					
SPAIN	+	yes	yes				+	no contact				
SWEDEN	+	yes	yes	yes			+	no contact				
SWITZERLAND	+	yes					0					
TURKEY	+	discussion					+	support pending				
UKRAINE	+	discussion					+	no contact				
UNITED KINGDOM	+	discussion					+	yes	yes			

Annex IX: Metadata required for the ETN-R

A. Provider information

A.1 Institution

- Name and abbreviation in the national language(s) and English (where available)
- Area of responsibility (region, state, district etc.)
- Postal address
- Other contact details (telephone and fax, website)
- Role of the institution: data owner, data distributor*, other
  **provided data are only distributed, ownership lies with another institution – please describe briefly who owns the data*
- Main function of the institution (short description)

A.2 Contact persons

Please provide contacts for the following issues: decision maker, everyday administrative issues, hydrology issues, and technical data issues.

- Name, Email address, telephone and fax number
- Role (general contact, overall decision-maker, legal expert, hydrological expert, technical expert, etc.)

A.3 Data categories

Please let us know whether your institution collects data about these topics

- River gauging stations
- River cross sections
- Reservoirs
- Lakes
- Weather radar / meteorological station

B. Data transfer information

Please provide some information about the data transfer, provided that this information is already available.

B.1 NRT data transfer options

- Record media: medium type by which a measured value or a result of the analysis procedure is recorded (online, digital, analogue etc.)
- Offline media: offline media by which the resource can be obtained (database, CD, DVD, Floppy, Tape, Cartridge, Cartridge tape, Hardcopy, etc.) *where applicable*
- Online source: online sources from which the resource can be obtained (URL), e.g. an ftp server *where applicable*
- Format name and version: name and version of the data transfer format (date, number etc.) or short description

B.2 Dataset identification

- Creation date: date at that the dataset with the NRT data is created
- Data language (language used in the dataset, usually the national language(s))
- Data contact: The person or the organisation unit that is responsible for the dataset. (*Please include contact details for this person under 1.2).*
- Update frequency: frequency with which changes and additions are made to the dataset after the initial dataset is completed (please provide time of update or interval in hours or minutes)
- Frequency of provision: frequency how often the dataset is provided to the GRDC

C. Information about the gauging stations

C.1 Station, river and catchment information

- Name of the station in the national language(s) and in English
- River name in the national language(s) and in English
- National station ID
- Other station IDs (where applicable, e.g. Hydra number)
- Primary catchment name (name of the sea-outlet catchment in English language)
- Catchment area upstream of the gauging station in km²

C.2 Location of the station

Please provide either coordinates or river kilometres and either elevation about the ground or gauge zero

- Local coordinates, Northing and Easting (please indicate reference system separately: projection, ellipsoid, etc.)
- Local elevation (please indicate reference system separately, e.g. metres above Adriatic see)
- Location on the river (river kilometre) – please describe the reference system and the origin of the river kilometre system separately (e.g. river mouth, border etc., including the coordinates of the origin)
- Latitude, longitude in decimal degrees according to WGS84 or other Geodetic systems (please specify separately which system is used for the station location)
- Altitude in above the surface of the WGS84 geoid or other Geodetic systems (please specify separately the reference system)

C.3 Other information

- Gauge zeros: zero of the gauging station in the national elevation system (please specify the national elevation system), including validity period begin and end (year, month, day)
  NOTE: Please provide not only the current gauge zeros, but also older gauge zeros.
- Influences that might have an effect on the observation: ice, weedage, backwater, tide, weir, reservoirs, dams, other.
- Time zone offset: time zone offset relative to UTC in standard (winter) time (e.g. UTC +1 for Germany, France, etc., UTC + 0 for UK and Portugal, UTC +2 for Finland, Romania, Lithuania)
  NOTE: If the time zone is identical for all stations, you can provide the information only once.

C.4 Observations at the station

*Please give this information for all stations and for every station **both** for river discharge and water level (where applicable).*

C.4.1 Observation mode and period

- Observed variable (river discharge or water level)
- Type of measurement:
  - Water level only
  - Discharge from water level (e.g. through rating curve)
  - Discharge directly
  - Measurement through a rated Structure (e.g. through a weir)
  - Other (please specify)
- Recording mechanism used at the station (data logger, chart, telemetry-only, etc.)
- Record media type: medium type by which the discharge/water level data are recorded at the station (digital and/or analogue)
- Transmission mode: the way how the observed/measured data are transmitted from the station to the NHS (automatic or not automatic)

C.4.2 Data availability and temporal resolution
- Date of the earliest available data (begin of observation)
- Date of the earliest available digital data
- Observation frequency or recording frequency:
  - continuous
  - 1-minute
  - 5-minute
  - 10-minute
  - 15-minute
  - 30-minute
  - hourly
  - 3-hourly
  - 6-hourly
  - 8-hourly
  - 12-hourly
  - daily
  - other intervals (please specify)

C.4.3 Evaluation of the observation
- Observation period completeness: percentage of interruptions to total time of observation or period during which the observation was interrupted (e.g. 10%, Jan 1993-Dec 1994 etc.)
- Reliability of the observation quality: overall assessment of the reliability of the observation (if known)

C.4.4 Other information
- Use limitations that affect the fitness of the resource (e.g. preliminary data, estimated data, simulated data, etc.)
- Flood Warning Site
- Availability of drawings/cross sections
- Measurement of rainfall at the station
- Is the gauge recording levels on a reservoir, lake or polder ?
- Availability of a stage-discharge relationship (available/not available for the station)
- Availability of flood frequencies (available/not available for the station)

D. Additional information needed for NRT stations
The following metadata are only needed for stations that have (near) real-time measurement and a catchment larger than 1000 km².

D.1 Critical discharge(s)

- Name in national language(s) and name or short description in English
- Abbreviation
- Value and unit
- Date of creation
- Reference period: year, month and day (begin and end)
- Validity period: year, month and day (begin and end)
- Data availability (digital and/or analogue)

D.2 Alert levels

- Name in national language(s) and name or short description in English
- Abbreviation
- Value and unit
- Date of creation
- Reference period: year, month and day (begin and end)
- Validity period: year, month and day (begin and end)
- Data availability (digital and/or analogue)

D.3 Highest and lowest observed discharge

- Name or short description in English
- Abbreviation
- Value and unit
- Date of occurrence
- Date of creation
- Reference period: year, month and day (begin and end)
- Data availability (digital and/or analogue)

Please provide at least highest and lowest observed discharge since the begin of regular observations (other basic hydrological statistical values, e.g. mean discharge, where available)

D.4 Stage-discharge relation

- Reference period: year, month and day (begin and end)
- Validity period: year, month and day (begin and end)
- Data availability (digital and/or analogue)
- Type (rating table, rating curve, rating function(s), other)

D.5 Flood frequencies

- Name in national language(s) and name or short description in English
- Abbreviation
- Value and unit
- Date of creation
- Reference period: year, month and day (begin and end)
- Validity period: year, month and day (begin and end)
- Data availability (digital and/or analogue)