

Report 46

GRDC Report Series

Twelfth Meeting of the GRDC Steering Committee

18 – 19 June 2015, Koblenz, Germany



Global Runoff Data Centre

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

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Report of the 12th GRDC Steering Committee Meeting

18 – 19 June 2015, Koblenz, Germany

Executive Summary

The biennial Global Runoff Data Centre (GRDC) Steering Committee Meeting was held in Koblenz, Germany from 18 to 19 June 2015.

The objective of the Steering Committee Meeting was to discuss progress and status of the various projects and activities of the GRDC made over the past two years. This was also a chance to fully inform the steering committee on potential future plans and at the same time the Steering Committee had to give advice, comment and sanction planned actions.

During the reporting period the following progress was made:

Since the previous Steering Committee Meeting data have been received from 20 countries and more than 3300 stations in the GRDC database could be updated. In the first months of 2015 new data have been received from Denmark (Greenland), Germany, Iceland, Namibia, Slovenia and South Africa. The overall number of stations in the GRDB has increased by 351 to 9213.

The number of data requests for river discharge data have increased by 10% compared to 2013 and the requests for GIS layers have remained stable. Overall data and information requests have increased from 370 to more than 400.

The Head of the GRDC stepped down as the co-chair of the WMO/OGC Hydrology Domain Working Group in June 2014. However, substantial time has been invested by GRDC staff in activities of the Hydrology Domain Working Group. In the HDWG representatives from numerous countries, administrations, scientific organisations and private vendors are engaged in developing standards for hydrological data exchange and conceptual models which support standardisation and domain specific metadata models. The activities within the HDWG have been presented and discussed and the GRDC has been tasked to continue with these activities and feedback the information to the WMO Information System and the WMO Commission for Hydrology (CHy).

The BfG and GRDC have been partners in the EU funded project GEOWOW until the finalisation of the project in August 2014. The main objective of the GEOWOW project has been to provide data from domains weather, ocean and water in a standardised way to the GEOSS Common Infrastructure. The involvement of the BfG and GRDC in this project has supported and enhanced activities on standardisation of hydrological data exchange that have been started in the Hydrology Domain Working Group. As a result the GRDC has now registered a dataset of approximately 300 stations in the GCI which are freely available via web services, after negotiations with the respective data providers.

Negotiations with the UNESCO EURO-FRIEND-Water community resulted in the decision that the European Water Archive (EWA), a specialised database for the EURO-FRIEND-Water community, can now be integrated into the GRDC database. Consolidated data re-

quests have already been sent to numerous European countries and data have been received for both GRDC and EWA, which now all can be included into the GRDB. Data will now be provided according to the GRDC data policy. Discussions with other FRIEND-Water projects around the world have commenced to offer to include the data from these projects also into the GRDC database. As the first step the Southern African FRIEND-Water database has already been successfully included into the GRDC database and data are made available to the research community since 2013.

Recommendations, based on the presentations and discussions during the Steering Committee have been summarised in tabular form in a work plan and are listed in Chapter 14.

Introduction

The GRDC was established at the Federal Institute of Hydrology (BfG), Koblenz, Germany in 1988 under the auspices of the World Meteorological Organization (WMO). It is a contribution of the Federal Republic of Germany to the World Climate Programme and the Hydrology and Water Resources Programme of the WMO. The WMO mandates and directly supports GRDC by its Resolutions 21 (Cg XII, 1995: Request to the member states to provide GRDC with river discharge data) and 25 (Cg XIII, 1999: Free and unrestricted exchange of hydrological data). Resolution 25 has been reaffirmed by WMO Congress XVII held in May/June 2015 in Geneva.

An International Steering Committee is guiding and directing the activities of the GRDC. This Steering Committee convenes every two years to review past developments of the GRDC and related international organisations, programmes and projects. At the same time the GRDC informs the Steering Committee on planned future projects and activities and is obtaining guidance from the Steering Committee.

1. Welcome and Opening of the 12th GRDC Steering Committee Meeting

The 12th GRDC Steering Committee meeting was opened on 18 June 2015 at 09:00 by Mr Michael Behrendt, Director- General of the Federal Institute of Hydrology (BfG). He expressed his appreciation that the GRDC Steering Committee has gathered at the BfG to guide the work of the GRDC.

He informed the meeting that the general constellation for the future work of the GRDC is looking good with the recent establishment of the UNESCO Category II Centre “Water Resources and Global Change” at the BfG and the relocation of the GEMS/Water Data Centre from Canada to the BfG in Koblenz. These three centres are funded by the Ministries of Transport and Environment and now these centres can together support the development of the Sustainable Development Goals, as agreed by members in the Rio+20 outcome document.

Mr Behrendt emphasised the importance of a quality service to customers and he pointed out that increased IT security concerns might impact on the efficiency of the GRDC. Furthermore he invited the attendees of the GRDC SC meeting to pay a visit to some of the laboratory facilities of the BfG.

In welcoming the Steering Committee members and observers he officially opened the 12th GRDC Steering Committee.

2. Introduction of participants and adoption of the agenda

Mr Hans Moser, the official chair of the GRDC Steering Committee has made apologies and has requested Mr Wolfgang Grabs to chair the meeting on his behalf.

Mr Grabs welcomed all participants and noted that all participants are familiar with each other and that no round of introduction was needed. He presented the Agenda and asked for changes and additions.

A one hour visit to the BfG laboratories on Friday morning was added to the agenda and with this amendment the agenda was adopted.

The list of the participants is included in Annex II.

3. Briefing on GRDC personnel resources, budget and infrastructure

Mr Grabs presented the budget for the GRDC and he noted that an overall budget increase was due to increased expenditure for staff and IT infrastructure. He noted that the Federal Institute of Hydrology has now hosted and supported the GRDC for more almost 27 years and there is currently no indication that this support will decrease.

He mentioned that the GRDC data acquisition is currently very successful and that a focus should be placed on the speedily integration of the available stations into the GRDC database. This should also be done considering the fact that the GRDC database administrator is heading for retirement within less than two years. This retirement will also have implications on the overall IT operations of the GRDC as it is likely that the GRDC will have to change the data holdings and operational software to a new system. It is anticipated that synergies with the newly established GEMS/Water Data Centre can be utilised in several aspects of the operations of the data centres.

4. WMO-Briefing on WMO sessions, meetings and developments relevant to GRDC

In his capacity as member of the WMO CHy Advisory Working Group (AWG) Mr Tony Boston informed the meeting about the WMO Congress XVII held from 25 May to 12 June 2015 and in addition he gave feedback from CHy Advisory Working Group activities which impact directly or indirectly on GRDC activities.

At the recent WMO Congress a new strategic plan was adopted with the related budget and Mr Petteri Taalas, Director-General of the Finnish Meteorological Institute, was elected and appointed as the next Secretary-General for a four-year mandate starting 1 January 2016.

The WMO 2016-2019 strategic plan includes amongst others the following priority areas which might have an impact on the GRDC:

Disaster Risk Reduction: Improve the accuracy and effectiveness of high quality impact-based forecasts and multi-hazard early warnings of extreme weather, climate, water and environmental events from the tropics to the poles.

Global Framework for Climate Services: Improve provision and use of climate services like seasonal to sub-seasonal predictions, especially for priority areas of food security, water management, health and disaster risk reduction.

WMO Integrated Global Observing System: strengthen the global observing and information systems for robust, standardized, integrated, accurate and quality assured relevant observations of the Earth System.

Polar and High Mountain regions: Improve operational meteorological and hydrological monitoring, prediction and services in polar and high mountain regions, where the scale of environmental change has significant implications on weather and climate patterns worldwide.

4.1. Congress XVII Document: Water Issues

By approving the plenary report of the Hydrology and Water Resources Programme, WMO Congress XVII is supporting the GRDC by endorsing the following:

- Congress recognized the continued support of the government of Germany to the GRDC over the past 27 years and the preparedness of the Global Water Data Center to provide additional services, especially in support of the development of WHOS, the GFCS and supply of hydrological information in support of SDG monitoring.
- Congress called on Members to continue to improve the provision of streamflow data to the GRDC.
- Congress also recognized the active role of the GRDC in the development of data sharing standards and practices.
- Congress reaffirms Resolution 25 (Cg-XIII) as an essential cornerstone in the efforts to seamlessly address weather, climate and water issues from scientific research to policy development and operational implementation;
- Congress urges Member States to comply with Resolution 25 (Cg-XIII, 1999) and thus to jointly address the challenges societies face with regard to climate change and the consequences of global changes.
- Congress requested CHy to monitor progress in the area of data operations and management and report to the Executive Council with regard to the evolving role of the GRDC and other related data centres, such as IGRAC and HYDROLARE, and their relationship with WMO, inter alia, with respect to the monitoring and measurement of the achievement of the SDGs and their contributions to other CHy initiatives.
- Congress noted the progress that had been made with respect to the application of WaterML 2.0.
- Congress noted that the WMO and UNESCO issued the third edition of the International Glossary of Hydrology in 2013.

Congress was informed of the recent establishment of the WMO Hydrological Observing System (WHOS) as the hydrological input to WIGOS. It noted that WHOS is being implemented in two phases, a short-term capability to access the hydrological data of NMHSs that are already freely and openly available online, which would be launched by July 2015, and a longer-term capability that is WIGOS and WIS compliant and makes use of a hydrological information system enabling data registration, data discovery, and data access. Congress welcomed this effort and urged the president of CHy to continue guiding WHOS to full implementation.

In Draft Resolution 4.1(5)/2 “WORLD HYDROLOGICAL CYCLE OBSERVING SYSTEM (WHYCOS) OFFICE” Congress requests:

- Members and funding agencies to, as appropriate, support the ongoing operations of the WHYCOS Office;
- The Secretary-General to establish the WHYCOS Office, to be funded by voluntary contributions;
- The president of the Commission for Hydrology, as chairperson of the WIAG, to oversee the implementation of the WHYCOS Office through the WHYCOS International Advisory Group (WIAG) and report back to the Executive Council on progress made.

4.2. Congress XVII Document: Global Framework for Climate Services

The World Climate Conference-3 (Geneva, 2009) unanimously decided to establish a Global Framework for Climate Services (GFCS), a UN-led initiative spearheaded by WMO. In the discussion on the data needs for the GFCS, Congress noted that Climate Change is now a reality and WMO is again faced with the need to develop agreement with respect to the international exchange of climate relevant data.

In Draft Resolution 8.1(2)/ “GFCS RELEVANT DATA AND PRODUCTS THAT SHOULD BE EXCHANGED AMONG MEMBERS TO SUPPORT THE IMPLEMENTATION OF THE GFCS” Congress noted that the hydrological data and products collected under Resolution 25 (Cg-XIII) are considered necessary for the implementation of GFCS, in addition to other data and products specified.

4.3. WMO Hydrological Observing System (WHOS)

Congress noted with appreciation in the Report of the President of the Commission of Hydrology (CHy) that, in association with CBS, CHy was progressing with a project, including testing, that could see the potential adoption of the WaterML 2.0 as a WMO standard for water information exchange. The adoption of WaterML 2.0 as a joint WMO/ISO standard will also greatly assist in the establishment of the WMO Hydrological Observing System (WHOS), as proposed by the president of CHy. WHOS is conceived as a portal to facilitate access to already available on-line real-time and historical data, drawing from the water information systems of countries around the world that make their data freely and openly available, including HYCOS projects. A prototype WHOS portal has been developed and the CHy Advisory Working Group has endorsed the concept and development of WHOS, and agreed that WHOS should represent the CHy contribution to WIGOS. Congress urged the promotion of WHOS among NHSs and the hydrological community.

Mr Boston further reported that the WHOS implementation is planned in two phases with:

- Phase 1: being the development of a map interface with links to those NHSs that make their real-time and historical stage and discharge data available online.

He presented the first examples that have been prepared for the CHy by AWG members showcasing the websites of NHSs from countries such as Australia, Belgium and Iceland.

- Phase 2: being a fully WIS/WIGOS compliant services-oriented framework linking hydrologic data providers and users through a hydrologic information system enabling data registration, data discovery, and data access. A Beta version should be ready for CHy-15 review and endorsement in November 2016 and an initial implementation for EC approval in June 2018.

GRDC could play a role in hosting WHOS access for some WMO members, but at this stage GRDC is providing a highly valuable service as a single access point to quality controlled historical discharge data.

Mr Boston concluded his presentation with the remark that the GRDC should register soon as a WIS/WIGOS Data Collection and Production Centre so that the station information is made discoverable on the WIS.

5. Objectives and expected outcomes of the meeting

Mr Grabs briefed the participants on the objectives and the expected outcomes of the meeting.

The following objectives and outcomes have been identified:

Objectives:

- Feedback to the Steering Committee on status of core activities (database and data dissemination status, product and services status)
- Feedback to the SC on activities and involvement of GRDC staff (e.g. WMO/OGC Hydro Domain Working Group and associated activities, support to WMO CHy and WIS/WIGOS)
- Obtaining information relevant to GRDC activities and operations from patrons, supporting organisations and partner data centres and programmes
- Guidance by the Steering Committee on GRDC future activities.

Outcomes:

- Recognition that GRDC core activities have the highest priority before additional requirements can be addressed. Core activities are:
 - Global data acquisition
 - Data maintenance
 - Data provision to the global research community
 - Metadata collection and provision
 - Quality assurance
 - Maintenance of the GRDC Website

Products

- Data

- GIS Products
 - Standardisation, metadata profile, HY_Features Model
 - Collaboration with partners to implement data solutions
-
- New technologies are emerging such as web services and data portals. Initial steps have been taken by the GRDC to make limited datasets and products available via web-services such as the newly calculated Global Freshwater Fluxes into the World Oceans and a subset of original time series data for selected GTN-R stations. Technical solutions need to be further adopted for the GRDC to comply with these developments and to implement these technologies in the GRDC environment.
 - Carefully balancing additional work with existing workload taking current GRDC staffing situation into consideration.

The overarching objective is to anchor the activities of the GRDC in international activities so that the supporting organisations and the research community better take not of GRDC services and progression.

6. Status report: 11th GRDC Steering Committee Meeting Action List

Mr Ulrich Looser, Head of the GRDC, used the Action List decided at the 11th GRDC SC Meeting in June 2013 to give an overview on progress and status of individual actions.

Task	Action by	Due date	Status November 2014
GRDC Core Activities			
Data acquisition, management and distribution	GRDC		Ongoing
Maintenance of current GRDC data and GIS products	GRDC		Ongoing
Website maintenance	GRDC		Ongoing
UNESCO related activities			
AP FRIEND, data integration into GRDC database, if feasible	GRDC	Sep. 2013	Attended AP-IHP Steering Committee Meeting in Nov 2014. Offer to host AP FRIEND data
Revitalise Met- FRIEND, EWA, LAC data cooperation activities and harmonisation	IRD, GRDC, UNESCO, FRIEND-Water	Discuss in Hanoi Feb. 2014	Discussed possible merging of all FRIEND-Water discharge data into GRDC in Montpellier in Oct 2014. Decision to integrate EWA into GRDC.
GCOS / GTN-H / GTN-R			
GCOS support letter to GTN-R member states	GRDC, GCOS Sec.	Dec 2013	Done
Inputs to GCOS Implementation Plan	GRDC		Ready to contribute
Inputs to GCOS 3rd Adequacy Report of the Global Observing Systems for Climate in Support of the UNFCCC (AR 3)	GRDC		Ready to contribute
Establish links to Global Observing Systems Information Center (GOSIC) in Asheville, North Carolina, USA	GRDC		Established
GTN-R acquisition part of core business, as good as possible	GRDC	Ongoing	Through GEOWOW project new thrust during 2013/14
WMO CHy / WIS / WIGOS related activities			
WMO/OGC HDWG activities, both coordination (co-chair responsibilities) and conceptual work for HY-Features and Metadata Profile	GRDC (Looser) GRDC (Dornblut)		Mr Looser stepped down as co-chair from the HDWG in June 2014. Ms Dornblut completed and published GRDC metadata profile (GRDC Rep. No. 39r2). HY-Features

Task	Action by	Due date	Status November 2014
			now OGC discussion paper. Preparations for OGC Standard in progress
Participation in the WMO Task Team on WIGOS Metadata (TT-WMD)	GRDC, WMO, CHy	Ongoing	Actively contributing and participating and representing CHy
Participation in the WMO Inter Programme Expert Team on WIGOS Framework Implementation (IPET-WIFI)	GRDC, WMO, CHy	Ongoing	Actively contributing and participating and representing CHy
Agreement of concepts, test and expand feature models to other hydro-domains,	Partner data centres		HY-Features de-facto implementations: AU_Geofabric, EU-WatERP, US National Flood Interoperability Experiment/USGS and was "tested" within AU-Geofabric, OWS-10
Climate sensitive stations			
Climate Sensitive Stations – Compilation of available data and metadata into GRDC database flagged as Pristine Basins subset	GRDC	Ongoing	Ongoing and included in standard data acquisition activities
Scientific reasoning for collecting the information (paper Steve Greb?)	UNESCO, WMO		Paper from Steve Greb distributed by UNESCO
Joint Data Products with Partner data centres			
Discussion at GTN-H			Done
Identify joint stations with GEMS/Water	GEMS/Water, GRDC	Ongoing	Done
EU Data requirements			
Establish working group, WMO invited by SC to convene a working group meeting Aim: Prepare for an agreement for access to hydro data and cooperation based on WMO policies plus member consent, data exchange mechanisms	WMO, EEA/EU, BfG/GRDC, RA VI Management Group, Observers from UN Organisations	Aug 2013	Follow-up discussions at WMO in Aug 2013 and Sept 2014 (RA VI Hydroforum, Warsaw). No final resolution at this stage.
Miscellaneous			
Submit data to GEMS/Water	GRDC/GEMS Water	Every 6 months	Ongoing until GEMStat had been transferred to Koblenz

Task	Action by	Due date	Status November 2014
Promote data requirements of partner data centres	Partner data centres	Ongoing	Ongoing

The discussion on the Action List items will be done either in the relevant Special Focus Session or after the presentations on the Status of the GRDC database, user and acquisition activities and the report on GRDC products and services.

7. Status report on GRDC Databases, User and Acquisition Activities

Mr Looser presented the status of the Global Runoff Database, the Special Datasets, Data Acquisition and Public Relations as well as an overview on Database and Information Requests to the GRDC:

- Summary statistics on the status of the Global Runoff Database including the development of stations in the database over time and the spatial distribution of the stations were presented. Since the previous GRDC SC meeting in 2013 more than 350 stations have been added to the database. Now river discharge data for 9,213 stations are available, adding up to approximately 386,000 station years with an average time series length of 42 years per station. In the first half of 2015 updates have been received for the following countries: Denmark (Greenland), Germany, Iceland, Namibia, Slovenia and South Africa.
- An overview on the status of the special databases operated by the GRDC was given and included the
 - Arctic Runoff Database (ARDB) including the emerging Arctic-HYCOS dataset
 - European Water Archive (EWA)
 - Southern Africa FRIEND database,
 - Climate Sensitive Stations Dataset
 - Global Terrestrial Network for River Discharge (GTN-R) a GTN-H and GCOS baseline monitoring network
 - GEOSS unrestricted access dataset (subset of GTN-H network)

Some of the datasets are subsets of the main GRDC database and are captured in a special project to represent the required network. Important additions to the GRDC database have been the gradual inclusion of EWA stations into the main database as a part of consolidated data requests and additional negotiations with NHSs mainly in WMO Region VI, Europe.

- Statistics on data dissemination activities have been presented. The need for global monitoring information can be clearly deduced from an increase of 10% for data related to projects on a global scale. The requests for global GIS layers continued at a high level. In total GRDC has handled successfully more than 400 data and information requests during 2014.

8. Report on GRDC Products and Services

Mr Looser gave an overview of the services and data products that are being offered by the GRDC. The most important aspects are summarised here:

- The GRDC is offering a number of data services to enable the users to select the stations suitable for their studies. These services include the provision of station catalogues and kmz files to filter desirable stations and visualize their spatial position in Google Earth. Furthermore the GRDC data services include the provision of requested data and products via Email and/or FTP. It is planned to provide the data in future via Sensor Observation Services (SOS).
- As part of the GEOWOW project the GRDC re-calculated in 2014 the Global Freshwater Fluxes into the World Oceans based on results from the global hydrological model WaterGAP (Doell et al., 2003) for 0.5° grid cell resolution. The annual and long-term means of freshwater fluxes calculated for land areas associated with the UNEP GIWA Regions (UNEP, 2014) are displayed on the GRDC website, as well freshwater fluxes from the 5° cells along the continent's coastlines. Freshwater fluxes calculated per 5° and 10° latitude bands show how much freshwater flows from a specific area into a specific ocean.
The annual freshwater inputs to the oceans within 5° and 10° latitudinal zones summarizing the individual flux values of the relevant 0.5° coastline cells are aggregated per decades and the reporting periods 1961-90 and 1971-00. For the reason of comparison with previous studies, these tables follow a design developed by Baumgartner et al. (1975).
The Global Freshwater Fluxes into the World Oceans are provided as a stand-alone Web service. The edition of July 2014 replaces the calculation from 2009. Previous estimates and estimates documented in literature are listed for comparison.
The applied geoprocessing workflow was compiled for the GRDC into a specially designed ArcGIS toolbox by UDATA - Umweltschutz und Datenanalyse Neustadt / Weinstraße, Germany (Wilkinson et al., 2014). This workflow will be used to regularly re-calculate the freshwater fluxes, at least when the WaterGAP inputs are updated by the team at the University Frankfurt, Germany.
- Further data products were mentioned, amongst others the GIS layers of the Major River Basins of the World and the GIS Shapefiles of more than 7,000 GRDC stations which are available since 2011.

9. Activities within the WMO/OGC Hydrology Domain Working Group

Ms Irina Dornblut, Deputy Head of the GRDC informed the meeting on GRDC's involvement in the WMO/Open Geospatial Consortium Hydrology Domain Working Group (WMO/OGC HDWG).

In 2009 the WMO/OGC HDWG was formed and supported by a MoU between WMO and OGC with the intention to enhance the development and the use of geospatial standards in the meteorology, hydrology, climatology and oceanography communities. The GRDC was involved right from the onset of the HDWG with two different responsibilities namely the:

- Coordination and Integration work at the co-chair level from 2009 until 2014
- Conceptual specification work mainly for the development of the HY-Features conceptual model based on semantics according to the WMO Glossary of Hydrology.

Since the last GRDC Steering Committee Meeting two Annual workshops were held, with the third one in preparation and 4 sessions at the OGC Technical Committee Meetings were conducted.

Currently the GRDC is leading the development of the HY-Features model, with the aim to have it adopted as an OGC standard prior to the 15th Session of the CHY in November 2016. The GRDC is busy with the formation of an OGC Standards Working Group (SWG). The SWG charter is under review until 23 July 2015, which will be followed by the start-up of the SWG.

The HY_Features model describes the most important hydrologic features by defining the fundamental relationships among the major components of the hydrosphere, including the hierarchy of basins and the segmentation of watercourses, to reflect hydrologic significance and topological connectivity of hydrologic features independent from geometric representation and scales. The conceptual model is described in an OGC Discussion Paper OGC 11-039r3: “HY_Features: a Common Hydrologic Feature Model”.

The principal goal of the HY_Features is to model the relationships of the Hydrologic Cycle conform to the common terminology endorsed by the WMO and also by the UNSECO, and recommended for use to their member countries. Thus, HY_Features is aimed to formalise the logical relationships defined within or inferred by the definitions documented in the WMO-UNESCO International Glossary of Hydrology (IGH) to provide a common model for referencing hydrologic features that can be used in terms of a high-level ontology.

The HY_Features model allows for a common and stable referencing wherever hydrologic features are required to be references,

- to assist hydrologic observations to identify the target feature-of-interest,
- to assist the aggregation of generated data represented in various data sets in current use into integrated suites of datasets on global, regional, or basin scales,
- to enable information systems to link distributed data across application domains,
- to enable cross-domain services to communicate by referencing common, shared concepts.

A new OGC Standards Working Group is being formed. The purpose of this Standards Working Group is to progress the HY_Features common hydrologic feature model to the state of an adopted OGC standard for a common and stable identification and referencing of hydrologic features.

This goal will be achieved by developing and publishing a draft standard, by processing comments received during a public comment period, and ensuring that the standard is consistent with the OGC Standards Baseline.

The Hydrologic Feature standard will be split into 3 parts, so that conceptual issues can be addressed separately from the GML schemas and machine-readable OWL versions of the model for practical use.

- Part 1: HY_Features conceptual model. The normative model is a machine-readable UML artefact published by OGC.
- Part 2: GML implementation schema suitable for data transfer of HY_Features object instances, based on ISO 19136 Annex E encoding rules for Application Schema.
- Part 3: OWL and RDF representation suitable for defining links between features that implement the HY_Features model, based on ISO 19150 encoding rules.

The final deliverable of the SWG will be separate versions of each intended part of the Hydrologic Feature candidate standard for consideration by the OGC membership for approval as an OGC standard.

10. Activities within WMO WIS/WIGOS representing CHy

As a result of the responsibilities within the framework of the WMO/OGC HDWG, several tasks to represent CHy interests within the WMO WIS/WIGOS implementation activities have been entrusted to GRDC staff. By now GRDC staff is representing the CHy in the following WIS/WIGOS Expert and Task Teams:

- WMO Task Team on WIGOS Metadata (TT-WMD) with main objectives:
 1. To identify the information that is needed to allow the majority of users to use WIGOS observations in appropriate contexts and in a defensible way;
 2. To create the WIGOS Core Metadata Standard that allows the essential information to be exchanged unambiguously, regardless of the format used for the transfer;
 3. To define a mechanism for maintaining the WIGOS Core Metadata Standard, including how metadata might be provided that is additional to the Core and coordinate with the ICG-WIGOS Task Team on Regulatory Material (TT-WRM) on any appropriate documentation as needed for WIGOS related Manual(s) and Guide(s);
- WMO CBS Inter Programme Expert Team on WIGOS Framework Implementation (IPET-WIFI) with main objectives:
 1. Address integration aspects of WIGOS as defined in the WIGOS Framework Implementation Plan;
 2. Provide technical advice, guidance, practices and procedures for WIGOS Framework Implementation
- IPET-WIFI Observing System Capability Analysis and Review Tool (OSCAR) Sub-Group
 1. Review the requirements for the surface based observing systems part of OSCAR, and advise with regard to future content management for surface-based capabilities within OSCAR;
 2. Assist the WMO Secretariat to fulfil its role – as detailed in the MoU with MeteoSwiss – with regard to the development of the OSCAR/Surface project by MeteoSwiss;
 3. Coordinate contributions from other OPAG-IOE Expert Teams to OSCAR Development with the special focus on surface based system capabilities; and
 4. Report to IPET WIFI on progress made.

- IPET-WIFI Sub-Group on Metadata
 1. Coordinate with ICG-WIGOS TT-WMD on requirements for a WIGOS Core Metadata Standard
 2. Contribute to the TT-WMD development of specifications for WIGOS metadata by provision of input on GOS sub-systems
 3. Develop proposals, in collaboration with TT-WMD, for GOS-related practices and procedures for implementation of WIGOS metadata standards and for maintenance of WIGOS Metadata
 4. Through IPET-WIFI contribute to WIGOS capacity development initiatives in regard to gathering, storing and exchanging GOS-related metadata, consistent with overall WIGOS metadata practices.

The activities within these working groups are coordinated with the CHy AWG representative for “Data Operations and Management” and the WMO Secretariat.

11. GRDC/BfG partner in the FP7 Project GEOWOW

From September 2011 until August 2014 the BfG/GRDC was engaged in the three year EU FP7 project “GEOSS interoperability for Weather, Ocean and Water” - GEOWOW. Together with the partners University of Bonn, 52°North and Kisters the main focus was on the work package “Water”. The reason for responding to the call was to support and enhance the standardisation efforts for hydrological data exchange.

The overall objectives of the GEOWOW project were to evolve the Global Earth Observation System of Systems (GEOSS) in general and the GEOSS Common Infrastructure (GCI) in particular in terms of interoperability, standardisation and functionality, to provide users with improved discovery, access and usability of Earth Observation data and services.

Efforts within the “Water” work package on the standardisation of hydrological data exchange are contributing to the activities of OGC within the WMO/OGC HDWG. The elaboration of the Sensor Observation Service 2.0 Hydrological Profile serves as an example.

The GRDC at the same time has utilised the progress in standardisation by testing and assessing software components from GEOWOW partners for their usefulness for GRDC purposes so that the data provision of GRDC data can happen via a standardised Sensor Observation Service using WaterML 2.0 Part 1. This service will be registered with the GEOSS Common Infrastructure and implemented within the near future.

To extend the hydrological data and products made available by the GRDC to the GCI, a semi-automated workflow has been developed and implemented within the framework of GEOWOW, to allow for the regular calculations of updated “Freshwater Fluxes to the World’s Oceans” as already discussed in Chapter 8.

12. Session on status of collaborating UN Specialised Agencies and Programmes, Initiatives and Partner Data Centres

12.1 UNESCO

Mr Grabs presented the Eighth Phase of the UNESCO International Hydrological Programme (IHP) on behalf of Mr Siegfried Demuth, who has given his apologies.

Phase VIII of the IHP titled “Water Security: Responses to Local and Global Challenges” focuses on six thematic areas to assist Member States in their challenging endeavour to better manage and secure water and to ensure the necessary human and institutional capacities.

- Water-related Disasters and Hydrological Change
- Groundwater in a Changing Environment
- Addressing Water Scarcity and Quality
- Water and Human Settlements of the Future
- Ecohydrology, Engineering Harmony for a Sustainable World
- Education, Key to Water Security

Apart from the six thematic areas of Phase VIII, the IHP covers a wide spectrum of programmes and initiatives. They are the:

- FRIEND (Flow Regimes from International Experimental and Network Data). An international research programme that helps to set up regional networks for analyzing hydrological data through the exchange of data, knowledge and techniques at the regional level
- GRAPHIC (Groundwater Resources Assessment under the Pressures of Humanity and Climate Change). A UNESCO-led project seeking to improve our understanding of how groundwater interacts within the global water cycle, how it supports human activity and ecosystems, and how it responds to the complex dual pressures of human activity and climate change.
- G-WADI (Global Network on Water and Development Information in Arid Lands). A global network on water resources management in arid and semi-arid zones whose primary aim is to build an effective global community to promote international and regional cooperation in the arid and semiarid areas.
- HELP (Hydrology for the Environment, Life and Policy). A new approach to integrated catchment management by building a framework for water law and policy experts, water resource managers and water scientists to work together on water-related problems.
- IFI (International Flood Initiative). An interagency initiative promoting an integrated approach to flood management which takes advantage of the benefits of floods and the use of flood plains, while reducing social, environmental and economic risks. Partners: the World Meteorological Organization (WMO), the United Nations University (UNU), the International Association of Hydrological Sciences (IAHS) and the International Strategy for Disaster Reduction (ISDR).

- ISARM (Internationally Shared Aquifer Resources Management). An initiative to set up a network of specialists and experts to compile a world inventory of transboundary aquifers and to develop wise practices and guidance tools concerning shared groundwater resources management.
- ISI (International Sediment Initiative). An initiative to assess erosion and sediment transport to marine, lake or reservoir environments aimed at the creation of a holistic approach for the remediation and conservation of surface waters, closely linking science with policy and management needs.
- JIIHP (Joint International Isotope Hydrology Programme). A programme facilitating the integration of isotopes in hydrological practices through the development of tools, inclusion of isotope hydrology in university curricula and support to programmes in water resources using isotope techniques.
- PCCP (From Potential Conflict to Cooperation Potential). A project facilitating multi-level and interdisciplinary dialogues in order to foster peace, cooperation and development related to the management of shared water resources.
- UWMP (Urban Water Management Programme). A programme that generates approaches, tools and guidelines which will allow cities to improve their knowledge, as well as analysis of the urban water situation to draw up more effective urban water management strategies.
- WHYMAP (World Hydrogeological Map). An initiative to collect, collate and visualize hydrogeological information at the global scale to convey groundwater-related information in a way appropriate for global discussion on water issues.

Here the GRDC is strongly involved in maintaining the databases for the FRIEND-Water community and is contributing the drainage network of the major basin of the world as a GIS layer to the WHYMAP initiative.

12.2 UNESCO FRIEND - Water

Mr Grabs presented the UNESCO IHP FRIEND-Water activities on behalf of Mr Henry van Lanen, who has given his apologies.

FRIEND-Water (Flow Regimes from International Experimental and Network Data) is UNESCO IHP's longest running programme. It was established in 1985 and it aims to improve water science and the sustainable use of current and future water resources.

One of the main challenges in understanding the natural-human system requires integrated knowledge from both natural and social sciences.

FRIEND-Water addresses these challenges and achieves its goals through:

- collecting and exchanging environmental (mainly river flow) data, particularly in an international context
- enhancing scientific understanding of hydrological processes across scales from local up to global
- developing innovative analytical tools for further improvement of water resource management and reduction of hydro hazard risks (floods and droughts)

- educating and developing capacity building pathways through PhD and MSc courses and technical training courses
- disseminating knowledge

In addition FRIEND-Water reflects the best in international cooperation between scientists, water managers, stakeholders and policy makers in UNESCO.

Attention need to be drawn to the weaknesses of FRIEND-Water which are:

- Lack to implement the work programme, without access to external funding
- No or irregular updates of databases with flow data
- Lack of funds to organize FRIEND-Water project workshops, technical courses which results in some dormant Regional Groups
- Lack of horizontal links and communication between Regional FRIEND Water groups on similar themes, e.g. extremes and erosion.

The Strengths of FRIEND-Water can be summarised in the following way:

- International scientific cooperation, shared data and common tools
- Disseminate scientific achievements (peer-reviewed papers, proceedings)
- Exchange and discuss scientific knowledge and skills (conferences, symposia, workshops)
- Transfer scientific knowledge, skills and tools through international training courses
- Support to PhD students, postdocs and junior scientists
- Interfacing with policy makers and stakeholders to various degrees.

The collection of hydrological data within FRIEND – Water databases is part of the programmes core business. The GRDC is hosting the European Water Archive for the EURO-FRIEND Water group. Since 2012 the hydrological data from the Southern Africa FRIEND have been included in the GRDC main database and are available for research and scientific applications according to GRDC data policy.

12.3 IAHS

Mr Christophe Cudennec, Secretary General of the International Association of Hydrological Sciences (IAHS) informed the meeting on the latest developments within IAHS and the potential impacts on hydrological sciences.

The IAHS is one of the eight constituent associations of the International Union of Geodesy and Geophysics (IUGG) and it was formed more than 90 years ago after World War I with the intention that science should bridge borders. Today the IAHS has more than 6300 members in almost 200 countries. It consists of ten commissions, all dealing with aspects of hydrology such as continental erosion, coupled land-atmosphere systems, groundwater, remote sensing, statistical hydrology snow and ice hydrology, surface water, tracers, water quality and water resources systems, working groups on education, precipitation and measurements and observations in the 21st century and finally

a decadal initiative “Panta Rhei – Everything Flows” 2013-2022. This scientific decade will be dedicated to research activities on change in hydrology and society.

Furthermore the meeting was informed about the IAHS publication services with more than 100,000 pages of the IAHS Red Book series, Proceedings of the International Association of Hydrological Sciences, or IAHSA available online with open-access since September 2014. Future papers published in the IAHS proceedings journal will be free to view/download, and so visible to a worldwide audience.

Mr Cudennec stressed the importance to publish scientific papers in peer reviewed journals and to utilise facilities like Research Gate, Google Scholar or Research ID for automatic citation tracking. This would also increase the visibility of data centres such as the GRDC.

Finally the meeting was informed about the upcoming 26th IUGG General Assembly in Prague at which the IAHS will holding its own symposia and workshops during which international prizes in hydrology for outstanding hydrological research will be awarded.

12.4 GCOS, Partner Data Centres (GPCC, IGRAC, GEMS/Water, HDROLARE)

This year’s GRDC meeting was held back-to-back with the 7th Coordination Panel Session of the Global Terrestrial Network - Hydrology (GTN-H). At this meeting, which is a joint effort of WMO, GCOS and GTOS with the main objective to link existing data centres, networks and systems for integrated observations of the global water cycle, presentations were held by representatives from GCOS, GPCC, IGRAC, GEMS/Water, HYDROLARE and GRDC. These presentations were not repeated at the GRDC Steering Committee Meeting, but information on the presentation will be summarised in the meeting document of the 7th GTN-H Coordination Panel Session from 16 to 17 June 2015 in Koblenz.

13. GRDC Strategy Discussion

The GRDC Strategy discussion focused on the development of a work plan and the determination of milestones for the 2015 - 2017 period.

The GRDC was requested to investigate the preparation of data products together with partner data centres. Extensive discussions have been held at the 7th Session of the GTN-H Coordination Panel which was held from 16 – 17 June 2015 in Koblenz.

It was realised that the GRDC involvement in the activities related to the HDWG are time consuming and that resource constraints are a limiting factor.

The following topics were addressed:

- Differences between UNESCO FRIEND - Water and GRDC data policies have been discussed again. It was noted that negotiations are showing success and that the EWA stations for which discharge data updates can be obtained from the NHSs will be inte-

grated into the GRDC and that these data will be made available under GRDC data policy conditions. The basis for this decision was the outcomes of a FRIEND - Water Meeting held at the 7th Global FRIEND - Water Conference in Montpellier, France in October 2014. The discharge data from the Southern Africa Flow Database of SA FRIEND-Water have already been successfully integrated into the GRDC. Negotiations with other FRIEND - Water (HKH, AP) have already commenced and will be continued.

- At the First WMO RA VI Hydrology Forum in 2012 the GRDC was tasked to develop data sharing procedures between NHSs and data centres. These procedures have been applied successfully and discussed again at the Second RA VI Hydrology Forum held in Warsaw in October 2014. NHSs are welcoming the consolidated data requests coming from the GRDC and the procedures are now widely applied in RA VI. Several European countries are now updating data regularly. Others make their quality controlled data available via websites. The concept of single consolidated data requests covering all aspects of GRDC data needs is now applied for all GRDC data requests.
- As part of the GEOWOW project the GRDC started negotiations with several data providers to make their contributed data freely available to the GTN-R network and to the GEOSS data core. Several countries have responded already positively and the GRDC makes time series data from selected stations freely available to the GEOSS data core. Negotiations with numerous countries are ongoing and the development of the GTN-R network is benefiting from these efforts. These negotiations will be extended to cover additional stations.
- Since March 2014 the GRDC is part of the Arctic-HYCOS Project Steering Committee. The purpose of the Arctic-HYCOS Project is to allow for the collection and sharing of hydrological data. This will allow EC-PORS and other initiatives to achieve the following two main scientific goals:
 - 1) To evaluate freshwater flux to the Arctic Ocean and Seas
 - 2) To monitor changes and enhance understanding of the hydrological regime of the Arctic region

The GRDC has been identified to host the quality controlled (historical) river discharge data for the Arctic-HYCOS Project. All Arctic-HYCOS countries provided their verbal agreement to the GRDC that contributed data identified as being part of the Arctic-HYCOS database should be made freely available. The GRDC is now finalising the list of Arctic-HYCOS stations with the various NHSs before making the discharge data available for download from the GRDC website.

- BALTEX (the Baltic Sea Experiment) was a Regional Hydroclimate Project (RHP) within the Global Energy and Water Exchanges Project (GEWEX) of the World Climate Research Programme (WCRP). Comprehensive discharge data have been collected as part of the studies. After completion of the BALTEX Project the GRDC offered to safeguard the discharge data and at the recent Baltic Earth Science Steering Group Meeting it was decided that the discharge data from the BALTEX project may be transferred to the GRDC for inclusion into the GRDC database. The GRDC will gradually include these stations into the GRDC database, flag them as BALTEX data and request permission from the individual countries to provide the data to the science community under GRDC data policy conditions.

- The WMO PR of Germany to the WMO has nominated the GRDC to participate in the RA-VI Working Group on Climate and Hydrology. The GRDC is prepared to contribute to these activities, in particular to the Task Team on Data Operations and Management as this would benefit the GRDC in better data acquisition initiatives. Initial discussions have been held and the Task Team will attend to the following topics:
 - RA VI /CCI Website on Data Rescue
 - Monitoring Network Design/Optimisation
 - Support for Standards Development
 - Support for Monitoring Systems
 - Harmonization of Quality Control/Data Access Methodologies
 - Promotion of Data Exchange and Sharing

- The GRDC is directly supporting several global projects such as the GEWEX-Hydroclimatology Panel (GHP), where GRDC has been recognised as a partner data centre. Other initiatives, such as the GFCS and projects of the WCRP are supported on request and several EU funded projects are supplied with data and with support when requested. These initiatives will be continued to maintain a close link between the data user community and their needs and the data providers.

- The status of the GRDC needs to be strengthened in order to secure long term funding and support from the current sponsors, the Federal Republic of Germany through the Federal Ministry of Transport and Digital Infrastructure and the BfG. While WMO Resolution 21 (Cg XII-1995) is supporting the GRDC it needs to be considered that this resolution is now 20 years old it is advisable that a new resolution be adopted. Therefore the GRDC Steering Committee urges the President of the Commission for Hydrology to make a recommendation to the 15th Session of the CHy in 2016 to have a follow-up GRDC resolution.

- GRDC will continue to promote its activities using various means (posters, flyers, papers, presentations, articles in newsletters, GRDC website and last but not least an efficient service) as it has a relative good idea on the data user community. More effort will be done to address different audiences according to their specific needs.

14. Adoption of key recommendations and action list

Based on the running activities at the GRDC and the emerging trends as discussed by the GRDC SC the following tasks and activities have been considered. Taking note of the resource constraints of the GRDC, the following action list was recommended by the 12th GRDC Steering Committee Meeting.

GRDC Action List as recommended at the 12th GRDC Steering Committee Meeting, June 2015

Task	Action by	Due date
GRDC Core Activities		
Data acquisition, management and distribution	GRDC	Ongoing
Maintenance of current GRDC data and GIS	GRDC	Ongoing

Task	Action by	Due date
products		
Website maintenance	GRDC	Ongoing
Integrate project related datasets, (FRIEND, Arctic-HYCOS, BALTEX etc.)	GRDC	Ongoing
UNESCO related activities		
Continue integration of FRIEND - Water databases into GRDC	GRDC, UNESCO FRIEND - Water Programmes	Ongoing
Follow-up and clarify with UNESCO IHP all FRIEND - Water data policy issues	GRDC, UNESCO, FRIEND- Water, IRD	June 2016
GCOS / GTN-H / GTN-R		
Inputs to ECV (Essential Climate Variables) documentation GCOS and TOPC	GRDC, GCOS Sec., TOPC	December 2015
Inputs to the GCOS Implementation Plan (IP)	GRDC, GCOS Sec.	March 2016
Inputs to GCOS 3 rd Adequacy Report on the Global Observing Systems for Climate in Support of UNFCCC (AR 3)	GRDC, GCOS Sec.	March 2016
GTN-R data acquisition part of core business, as good as possible	GRDC, GCOS, CHy	Ongoing
WMO CHy, WIS/WIGOS related activities		
WMO/OGC HDWG activities, conceptual work for HY-Features	GRDC	November 2016
Participation and representation of the CHy at in WMO Task Team on WIGOS Metadata (TT-WMD)	GRDC, CHy AWG, WMO	Ongoing
Participation and representation of the CHy in the WMO Inter-Programme Expert Team on WIGOS Framework Implementation (IPET-WIFI)	GRDC, CHy AWG, WMO	Ongoing
Participation and representation of the CHy in the IPET-WIFI Observing System Capability Analysis and Review Tool (OSCAR) Sub-Group	GRDC, CHy AWG, WMO	Ongoing
Participation and representation of the CHy in the IPET-WIFI Metadata Sub-Group	GRDC, CHy AWG, WMO	Ongoing
Participation and representation of GRDC in the WMO RA VI Working Group on Climate and Hydrology	GRDC, CHy, WMO RA VI	Ongoing
Participation and representation of GRDC in the WMO RA VI Hydrology Forum	GRDC, CHy, WMO RA VI	Ongoing
Climate sensitive stations		
Acquisition of data for climate sensitive stations (Part of standard data acquisition activities)	GRDC, NHSs	Ongoing

Task	Action by	Due date
Scientific reasoning for collecting discharge data from Climate Sensitive Stations	GTN-H, Pres. CHy, WMO	November 2016
Joint Products with Partner data centres		
Discussion at GTN-H		
Identify joint stations with GEMS/Water	GEMS/Water, GRDC	
Miscellaneous		
Complete DCPC registration process for GRDC	GRDC, DWD, WMO	December 2015
Register GRDC datasets (GTN-R, Arctic-HYCOS, etc.in GEOSS Portal)	GRDC, GEO	December 2015
Investigate DOIs for selected datasets (initially GEOSS Portal datasets)	GRDC	December 2015
Promote data requirements of partner data centres	Partner data centres	Ongoing

15. Any other business

No discussion items were raised under this point, but the members of the GRDC Steering Committee thanked the BfG and the responsible people for the arrangement of a visit to the ecological and organic chemistry laboratories of the BfG.

16. Date and Venue of next GRDC SC Meeting

The interval of the GRDC SC meetings was reviewed and it was decided to stick to the biennial meeting cycle. The tentative date for the next GRDC SC meeting was set for June 2017 after the Session of the WMO Executive Council. Koblenz as the venue was accepted by the SC Meeting.

17. Closure of the meeting

Steering Committee members commended the GRDC on the work done over the last two years and also thanked the BfG for providing the facilities and environment in which this meeting was held.

The Steering Committee members were thanked for their constructive and positive contributions and willingness to support the GRDC.

While wishing everybody a safe journey back home Mr Grabs closed the 12th GRDC Steering Committee Meeting at 12:15.



ANNEX I Agenda

Thursday, 18 June 2015

08:30 – 09:00 Registration (Tea and Coffee)

09:00 – 17:00 (10:30 – 11:00 Coffee break, 12:30 – 13:30 Lunch, 15:00 – 15:30 Coffee Break)

09:00 - 10:30 Opening, Introduction, Background and feedback

- **Opening of the 12th GRDC Steering Committee Meeting**
- **Introduction of participants and adoption of the agenda**
- **Briefing on GRDC personnel resources, budget and infrastructure**
- **Objectives and expected outcomes of the meeting**
- **WMO-Briefing on outcomes of the 17th Congress in 2015, the 67th Session of the WMO Executive Council in June 2015, the latest CHy Advisory Working Group Session and other developments relevant to GRDC**

11:00 - 12:30 Feedback (continued), GRDC key projects and status reports

- **Feedback: 11th GRDC Steering Committee Action List**
- **GRDC Status Report and discussion**
- **Activities within the WMO/OGC Hydrology Domain Working Group**

13:30 - 15:00 Session on collaborating UN Agencies, Programmes and Initiatives

15:30 – 17:00 GRDC Strategy Discussion

17:00 Session adjourns

Friday, 19 June 2015

**09:00 – 10:30 GRDC Strategy Discussion (continued),
Adoption of key recommendations and action plan**

10:30 – 11:00 Coffee Break

11:00 – 12:00 Closure

- **Summary of conclusions and recommendations**
- **Any other business**
- **Date and Venue of next GRDC SC Meeting**

Closure of the 12th GRDC Steering Committee Meeting



ANNEX II List of Participants

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ANNEX III Composition of the GRDC Steering Committee

Chairman:

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Secretariat:

Global Runoff Data Centre
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Members:

- WMO: World Meteorological Organization
- CHy: Commission for Hydrology of WMO
- CWD: Climate and Water Department of WMO
- HWRP: Hydrology and Water Resources Programme of WMO
- UNESCO: United Nations Educational, Scientific and Cultural Organization
- UNESCO Water: UNESCO Water Programmes
- UNEP DEWA: UNEP Division of Early Warning and Assessment
- ICSU: International Council for Science / IAHS: International Association of Hydrological Sciences
- BfG: Federal Institute of Hydrology
- GPCC: Global Precipitation Climatology Centre
- GWPO: UN GEMS/Water Programme Office of UNEP/DEWA
- IGRAC: International Groundwater Resources Assessment Centre
- HYDROLARE Data Centre for the Hydrology of Lakes and Reservoirs
- FRIEND: Flow Regimes from International Experimental and Network Data
- WCRP: World Climate Research Programme sponsored by IOC, WMO, ICSU
- Government of Japan, represented by the River Bureau of the Ministry of Land, Infrastructure and Transport of Japan (MLIT)

Observers:

- IHP/HWRP German Secretariat of the IHP of UNESCO and the HWRP of WMO
- GCOS: Global Climate Observing System sponsored by IOC, WMO, ICSU and UNEP
- GEO: Secretariat of the Group on Earth Observation
- GWSP: Global Water System Project, International Project Office
- WWAP: World Water Assessment Programme



ANNEX IV

Acronyms

AP – FRIEND	Asian Pacific Flow Regimes from International and Experimental Network Data
AR 3	GCOS 3rd Adequacy Report of the Global Observing Systems for Climate in Support of the UNFCCC
Arctic-HYCOS	Arctic Hydrological Cycle Observing System
ARDB	Arctic Runoff Data Base
AU-BoM	Australian Bureau of Meteorology
AU – Geofabric	Australian Hydrological Geospatial Fabric
AWG	CHy Advisory Working Group
BALTEX	The Baltic Sea Experiment
BfG	Bundesanstalt für Gewässerkunde (Federal Institute of Hydrology)
CBS	WMO Commission for Basic systems
CCI	Commission for Climatology
Cg	WMO Congress
CHy	Commission for Hydrology (WMO)
DCPC	Data Collection or Production Centre
DOI	Digital object identifier
DP	Discussion Paper
DWD	Deutscher Wetterdienst
EC	WMO Executive Council
EC-PORS	EC Panel of Experts on Polar Observations, Research and Services
ECV	Essential Climate Variable
ECMWF	European Centre for Medium-Range Weather Forecasts
EEA	European Environment Agency
EU	European Union
EURO-FRIEND	European Flow Regimes from International Experimental and Network Data Sets
EWA	European Water Archive
FP7	European Union Seventh Framework Programme for research and technological development
FRIEND	Flow Regimes from International Experimental and Network Data Sets
FTP	File Transfer Protocol
GCI	GEOSS Common Infrastructure
GCM	GCOS Cooperation Mechanism
GCOS	Global Climate Observing System
GEMStat	Global Water Quality Database of GEMS/Water
GEMS/Water	Global Environmental Monitoring System for Water
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GEOWOW	GEOSS interoperability for Weather, Ocean and Water
GEWEX	Global Water and Energy Exchanges Project
GEWEX GHP	GEWEX Hydroclimatology Panel
GFCS	Global Framework for Climate Services
GIS	Geographic Information System

GIWA	UNEP Global International Waters Assessment
GML	Geography Markup Language
GOS	Global Observing System
GOSIC	Global Observing Systems Information Center
GPCC	Global Precipitation Climatology Centre
GRDB	Global Runoff Database
GRDC	Global Runoff Data Centre
GTN-H	Global Terrestrial Network – Hydrology
GTN-R	Global Terrestrial Network for Rivers
GWPO	UN GEMS/Water Programme office
GWSP	Global Water System Project
HDWG	Hydrology Domain Working Group within the OGC
HKH	Hindu Kush Himalayas
HWRP	Hydrology and Water Resources Programme (WMO)
HYCOS	Hydrological Cycle Observing System
HYDROLARE	International Data Centre on the Hydrology of Lakes and Reservoirs
HY_Features	Common Hydrologic Feature Model
IAHS	International Association of Hydrological Sciences
ICG-WIGOS	Inter-Commission Coordination Group on the WMO Integrated Global Observing System
ICSU	International Council for Science
IGH	International Glossary of Hydrology
IGRAC	International Groundwater Resources Assessment Centre
IHP	International Hydrological Programme
IPET – WIFI	Inter Programme Expert Team on WIGOS Framework Implementation
IRD	L'Institut de recherche pour le développement
ISO	International Organization for Standardization
IT	Information Technology
IUGG	International Union of Geodesy and Geophysics
KMZ	Keyhole Markup Language
LAC – FRIEND	Latin America and the Caribbean Flow Regimes from International Experimental and Network Data Sets
Met – FRIEND	Mediterranean Flow Regimes from International Experimental and Network Data Sets
MoU	Memorandum of Understanding
NHS	National Hydrological Service
OGC	Open Geospatial Consortium, Inc.®
OPAG – IOS	Open Programme Area Groups on Integrated Observing Systems
OSCAR	Observing System Capability Analysis and Review Tool
OWL	Web Ontology Language
OWS-10	OGC Web Services Testbed -10
PR	Permanent Representative
RA – VI	WMO Regional Association VI (Europe)
RDF	Resource Description Framework
RIO+20	United Nations Conferences on Sustainable Development (UNCSD)
SA – FRIEND	Southern Africa FRIEND
SC	Steering Committee

SDG	Sustainable Development Goals
SG – OD	Sub- Group on OSCAR Development
SOS	Sensor Observation Services
SWG	OGC Standards Working Group
TC	OGC Technical and Planning Committee Meeting
TT – WMD	Task Team on WIGOS Metadata
TT – WRM	Task Team on WIGOS Regulatory Material
TOPC	Terrestrial Observation Panel for Climate
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USGS	United States Geological Survey
WaterML 2.0	Water Markup Language 2.0
WatERP	FP7 funded project on Water Enhanced Resource Planning
WCRP	World Climate Research Programme
WHOS	WMO Hydrological Observing System
WHYCOS	World Hydrological Cycle Observation System
WHYMAP	World-wide Hydrogeological Mapping and Assessment Programme
WIAG	WHYCOS International Advisory Group
WIGOS	WMO Integrated Observing System
WIS	WMO Information System
WMO	World Meteorological Organization
WMO RA-VI	WMO Regional Association VI (Europe)
WWAP	World Water Assessment Programme



Report No. 1 (May 1993)	Second Workshop on the Global Runoff Data Centre, Koblenz, Germany, 15 - 17 June, 1992.	(17 pp, annex 73 pp)
Report No. 2 (May 1993)	Dokumentation bestehender Algorithmen zur Übertragung von Abflußwerten auf Gitternetze. (incl. an English abstract in English by the GRDC: Documentation of existing algorithms for transformation of runoff data to grid cells) / G.C. Wollenweber.	Out of print (71 pp)
Report No. 3 (Jun 1993)	GRDC - Status Report 1992.	(5 pp, annex 5 pp)
Report No. 4 (Jun 1994)	GRDC - Status Report 1993.	(16 pp, annex 34 pp)
Report No. 5 (Nov 1994)	Hydrological Regimes of the Largest Rivers in the World - A Compilation of the GRDC Database.	(275 pp)
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