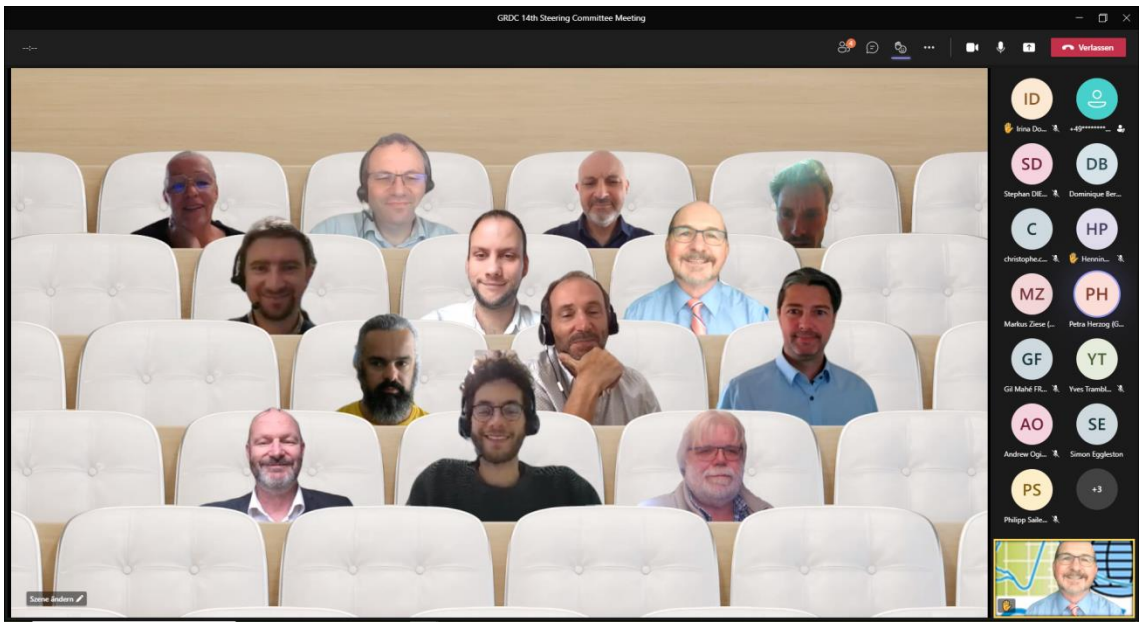
Meeting Notes

Fourteenth Meeting of the GRDC Steering Committee

1 July 2021, 09:00 – 12:45 CEST - Virtual



Global Runoff Data Centre

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

Table of Contents

Notes of the 14th GRDC Steering Committee Meeting

1 July 2021, 09:00 – 12:45 CEST - Virtual

1. Welcome and Opening of the 14th GRDC Steering Committee Meeting

The 14th GRDC Steering Committee Meeting was opened on 1 July 2021 at 09:00 by Ms Petra Herzog, representing Ms Birgit Esser, Director-General of the Federal Institute of Hydrology (BfG). Representatives from WMO, UNESCO, IAHS, GCOS, FRIEND-Water, GEO and IRD were welcomed together with representatives from GTN-H, partner data centres and staff from BfG and GRDC. BfG is hosting GRDC for almost 33 years and it is part of the international obligations BfG has taken on together with hosting the UNESCO Category 2 Centre on Water Resources and Global Change and the Global Water Quality Database GEMStat which operates under the auspices of UNEP. Currently BfG is in a process of creating a home for ISMN, the International Soil Moisture Network.

BfG is delighted to host GRDC and is committed to make financial resources available to ensure GRDC's long term support as a German contribution to UN Organisations.

This virtual meeting is more of an informative nature to brief the Committee on the changes and developments that happened at GRDC, and to be informed about the role of hydrology in the newly restructured WMO.

In welcoming the Steering Committee members and observers Ms Herzog officially opened the 14th GRDC Steering Committee.

2. Introduction, background and Feedback

2.1. Introduction of participants and adoption of the agenda

Ms Petra Herzog, BfG Division Head for Quantitative Hydrology, officially chaired the meeting. All participants were given a chance to introduce themselves.
The agenda was adopted without changes.
A list of the participants is included in ANNEX II.

2.2. Briefing on GRDC personnel resources, budget and infrastructure

The Chair, Ms Herzog informed the meeting that GRDC is currently experiencing a substantial change in staff. Two colleagues retired since the last meeting and a third person will be retiring at the end of 2021. Two new staff members have been recruited for GRDC.
The chair presented the budget for the GRDC and noted that the budget has increased by approximately 18% since 2017. Expenses for staff remained more or less stable. Expenses related to office space, maintenance and IT infrastructure and the implementation of the new data management system and the data portal increased overall expenses for GRDC operations to 770,000 Euros for 2020. The Chair emphasised that the Steering Committee should please note that the Federal Institute of Hydrology has now hosted and supported

GRDC for almost 33 years. Currently both the Institute for Hydrology and its funding Ministry of Transport and Digital Infrastructure signal clear support to the operations of GRDC for the foreseeable future.

2.3. WMO-Briefing on status of hydrology in the new WMO structure, feedback from EC-73 and the future role of data centres under auspices of WMO

In his capacity as Head, Earth System Monitoring Division, Infrastructure Department of the WMO, Mr Dominique Bérod informed the meeting on the status of hydrology within the new WMO structure.
Hydrology is now well represented within WMO structures from hydrological experts contributing to various standing committees all the way up to the Hydrological Coordination Panel and the Hydrological Assembly advising the Congress on hydrological matters. Within the WMO Secretariat the "Hydrology and Water Resources Division" is part the Services Department and supporting the intergovernmental Commission for Services (SERCOM) and the "Earth System Monitoring Division" including its Hydrology Monitoring Unit which is part of the Infrastructure Department, supporting the intergovernmental Commission for infrastructure (INFCOM). A third unit "Water and Cryosphere" ensures the overall coordination across departments and commissions.
Major activities related to hydrological monitoring are continuing their developments.
The WMO HydroHub is looking at the next generation of water monitoring technologies including low-cost sensors, IoT, citizen observations, video processing, satellite altimetry, AI and machine learning, allowing new developments of the long-lasting monitoring program WHYCOS (World Hydrological Cycle Observing System).
WHOS, the WMO Hydrological Observing System is developed as the hydrological component to the WMO information system WIS.
HydroSOS, the Hydrological Status and Outlook System will provide information on current and future hydrological conditions at global, regional and national scales.
The second Phase of the World Water Data Initiative (WWDI) has amongst others the objective to "support countries in their water-related policy development – including free and unrestricted data exchange". Currently WWDI contributes to the new, unified WMO data policy for the international exchange of Earth system data, which already has been approved by INFCOM and Executive Council-73. It will be submitted to the Extraordinary Session of the WMO Congress (Cg-Ext 2021) in October 2021 for approval.
It must be noted that those activities are developed in the framework of the new WMO Earth System approach and hydrological monitoring will be gradually integrated into WIGOS and its various tools, including OSCAR for metadata management.

The overarching "Hydrology Action Plan" is supported by all these activities and is dealing with the following broad themes:

1. Floods
2. Drought and food security
3. Interface with science
4. Water resource assessments and SDG linkages
5. Water quality
6. Cross-cutting issues

The Hydrology Action Plan will also be submitted to the WMO Congress (Cg-Ext 2021) in October 2021.

With the mandate from the former Commission for Hydrology (CHy) WMO is busy with an assessment of the data centres GRDC, HYDROLARE, IGRAC and GPCC if required, in the new landscape and structure of WMO. It is evident that the hydrological data centres will contribute to the Earth System Monitoring approach of WMO and here Mr. Bérod pointed out that" GRDC has a key role to play and its support is highly needed and appreciated".

3. Contributions and feedback on GRDC key activities and status report

3.1. Status report on GRDC, User and Acquisition Activities

Mr Ulrich Looser, Head of GRDC, presented major changes that occurred at GRDC over the past 4 years due to the introduction of a new data management system and the development of a download portal and the updating of basically all GRDC geospatial data products. Additionally the operational environment of GRDC, main activities, networking with external parties, data acquisition activities, linkages to the data user community and data policy issues were presented.

The main functions of GRDC as global data centre constitutes:

- Data acquisition in consultation with National Hydrological Services
- Harmonisation of data received in different data formats, units of measure and calendars
- Plausibility checks of received historical river discharge data and associated metadata
- Data management of river discharge data and station metadata in the GRDC database
- Dissemination of historical discharge data in standardised data formats to the scientific and research user communities.

Despite the migration of the Global Runoff Database (GRDB) to the new data management system and the portal development, data acquisition has been successful and in total more than 80 data deliveries, both updates and additional stations have been received. 22 countries from all WMO regions provided discharge data for the first time since more than 2 decades. Overall more than 1,000 additional stations were added to the database.
After thorough assessment GRDC river discharge data are included in the WMO Catalogue for Climate Data since 2019.

GRDC continued to maintain and strengthen its links to international programmes and trans-national projects. This involved participation in WMO Expert Teams contributing to hydrological topics, providing support to the UNESCO IHP and FRIEND-Water communities on river discharge database integration, contributing to GCOS status and related documents, looking after the ECV river discharge within TOPC and backing GTN-H activities with secretarial services and in kind contributions on pilot developments. The cooperation with partner data centres continued with representing and promoting each other at various occasions, with joint product development and data acquisition initiatives.

In January 2018 the OGC® Implementation Standard "WaterML 2: Part 3 - Surface Hydrology Features (HY_Features) - Conceptual Model", developed with strong GRDC involvement, was officially approved by OGC.

Linkages to climate related projects and programmes such as GEWEX, utilising GRDC discharge data were maintained, and numerous cooperation agreements with research institutions and universities have been concluded. The growing demand for river discharge data by the international scientific community dealing with global change, climate and hydrological modelling and related studies have been successfully met. Before going online, the GRDC data policy was implemented in the new Download Portal and confirmed by WMO in March 2020.

Information of GRDC data and related products are presented on the GRDC Website. Furthermore GRDC has registered all datasets and products on the Geoportal of the Federal Institute of Hydrology. From there they are harvested by numerous other portals including the GEOSS Portal of GEO. As a WMO DCPC all GRDC datasets and products are also registered on the WIS at the DWD GISC.

Several data products have been updated or developed. Amongst them the geospatial data products "Major River Basins of the World" and "WMO Basins and Sub-Basins", now based on the higher resolution mapping product "HydroSHEDS". The products "Watershed Boundaries of GRDC Stations" and Annual Characteristics and Long-Term Statistics of GRDC Timeseries Data" are now included in the functionality of the download portal.

The GRDC Download Portal and the latest product "Freshwater Fluxes into the World's Oceans" have been presented separately.

3.2. Status Global Runoff Database and GRDC Download Portal

Mr Henning Plessow joined GRDC in September 2020. He provided information on the GRDB and gave an online demonstration of the GRDC Download Portal.

GRDB is constantly growing and contains currently 10,361 stations, an increase of more than 1,100 stations since the last Steering Committee meeting. Overall, GRDB holds now 470,000 station years of river discharge data with an average timeseries length of 45 years. The longest timeseries measures 214 years, from 1804 to 2020. The data are maintained in an Oracle database which is fully integrated in the BfG secure IT-Infrastructure with regular back-ups and maintenance.

The GRDC Download Portal is operational since 8 July 2020. It provides easy access to GRDC timeseries data. There are two ways of accessing data. Firstly a selection is possible via WMO Sub-Regions, with the option to select more than one sub-region at a time. The selection can be done via map, list or tiles depicting individual sub-regions. The second option is via Station Download. Here several filter and selection options are available, such as water body name, country, region and sub-region. A list containing GRDC station numbers can also be entered into a search field. After requesting a download, the user has to fill in a form providing email address, institution, purpose of data use and data format. The user can choose from a selection of formats including GRDC Export and Statistical Formats, WaterML2, NetCDF and ZRXP. Before invoking the request the user has to agree to GRDC Terms of Use and Data Sharing Conditions. After submitting the request, data are extracted from the database and then the user is informed from where to download the data via the email address provided.

GRDC website provides comprehensive information on the use of the Download Portal.

From the data entered in the request form, GRDC can generate statistics to inform data providers via the GRDC website. Here are some key findings after one year of portal operation. With the portal, data requests have increased by a factor of 20 to 9,300 downloads within one year. Over 90% of the requests are coming from academia and research institutions. GRDC Export Formats are selected in more than 90% of the requests with NetCDF formats coming in second. Climate, hydrometeorology and regional hydrology studies constitute approximately 80% of the studies. Global studies are specified in over 10% of the requests. Regional studies are focusing on Africa, Asia and Europe.
Making river discharge data available via the Download Portal has been well received by the data users with positive feedback. It should be noted that about 2.9 Million timeseries have been provided to users from more than 120 countries. With the interest in river discharge data from all over the World, GRDC truly lives up to its name as a global data centre.

3.3. GRDC Data Product Development

Mr Thomas Recknagel joined GRDC two years ago and his focus is on product development.
Introducing his presentation he pointed out that in 1989 the World Climate Research Programme Report 22 describing the operations of GRDC already identified the need of global runoff datasets for climate model validation and calibration. Especially "monthly data on runoff into the oceans are needed for validation of coupled ocean-atmosphere climate models". Responding to that need the first assessment of freshwater fluxes into the World's oceans was prepared by GRDC in 1996: (W. Grabs, Th. de Couet, J. Pauler (1996): *Freshwater Fluxes from Continents into the World Oceans based on Data of the Global Runoff Data Base*, GRDC Report 10).
GRDC recalculated the freshwater fluxes in 2004, 2009 and 2014. The latest recalculation was done in 2020 based on the model results v2.2d of the continuously developed water balance model WaterGAP (Hydrology Group, University of Frankfurt) for the period 1901-2016.
R-Studio is currently being used by a growing hydrological community for the development of web applications. Mr Recknagel spearheaded the implementation of the necessary infrastructure including training at the BfG. The Web Application for the most recent "Freshwater Fluxes to the World's Oceans" is the first R-Studio/Shiny application operated at BfG. The life demonstration of the freshwater fluxes application was supported by Mr Plessow. Map layers present the freshwater fluxes by continent, by ocean or for specific land areas, for example those associated with the UNEP GIWA Regions (UNEP 2006). Freshwater fluxes per 5° and 10° latitude bands and through 5° coastline cells show how much freshwater flows from a specific land area into a specific ocean through a particular stretch of coast. Tabular summaries present the continental fluxes into 5° or 10° latitude bands within predefined reference periods. The design of tables consistently follows a template from the publication Baumgartner, Albert, and Eberhard Reichel (1975), *The World water balance*, Vol. 179, Elsevier New York, to assure comparability with previous calculations and across variable reference periods. Estimations of continental runoff or freshwater input to oceans made by other authors are listed for comparison as documented in literature. Previous GRDC data sets prepared in 2004, 2009 and 2014 are integrated into the service.

A brief outlook on future developments to make GRDC geospatial products and services available via web applications concluded the presentation of GRDC activities.

4. Contributions from participating parties and general discussions

In general the presentation by GRDC staff was well received.

Mr Christophe Cudennec (IAHS Secretary General) enquired whether the download portal provides an API for automatic harvesting. WMO initiatives to introduce a unified data policy on unrestricted access to identified datasets and WMO developments such as the WHOS and HydroSOS would benefit from automatic data harvesting functionality, so would the scientific and research communities. In response it was stated that under current data policy automatic harvesting was not possible.

Furthermore Mr Cudennec suggested increasing marketing of GRDC datasets and services. Joining the Research Gate community or opening a GRDC Github account were suggestions to promote GRDC and at the same time obtain information on research produced with GRDC data. The publication of a GRDC curation article in the Hydrological Sciences Journal (HSJ) was strongly recommended. GRDC activities should also be promoted through participation in summer schools offered by organisations active in capacity building.

Both Mr Cudennec and Mr Douglas Cripe from the GEO Secretariat suggested promoting GRDC services, especially the product "Freshwater Fluxes to the World's Oceans", in the ocean monitoring and modelling communities. GEO is supporting the "UN Decade of Ocean Science for Sustainable Development" which runs from 2021 to 2030 and is willing to facilitate the contact to the ocean science community.

Mr Gil Mahé from the French National Research Institute for Sustainable Development (IRD) and coordinator of the Global FRIEND-Water (Flow Regimes from International Experimental and Network Data) community informed the meeting about new regional FRIEND-Water coordinators in Asia and Latin America. Furthermore he encouraged an improved cooperation between GRDC and the FRIEND-Water databases maintained and archived by IRD. Difficulties of obtaining data especially from West Africa and the Maghreb region are known but this should not discourage GRDC from data acquisition activities. Cooperation within the context of FRIEND-Water should continue.

Mr Yves Tramblay from HydroSciences Montpellier (HSM) enquired on the status of an international database on sediment and sediment transport. This aspect is of importance but does not fall within the responsibility of GRDC. However, discussions on the need for such a database are ongoing within the International Sediment Initiative (ISI) of UNESCO-IHP, and interested parties including BfG and ICWRGC.

5. Date of next Meeting, any other business and Closure

5.1. Date and Venue of next GRDC Steering Committee Meeting

The interval of the GRDC SC meetings was reviewed and it was decided to adjust the meetings to a three year cycle. The tentative date for the next GRDC SC meeting was set for June 2024 after the Session of the WMO Executive Council. Koblenz as the venue was accepted by the Steering Committee Meeting.

5.2. Any other business

No discussion items where raised under this point.

5.3. Closure of the meeting

Mr Bérod thanked the German Government and the BfG on behalf of the WMO for funding and hosting GRDC over the past 32 years and commended the GRDC team on the work done over the last years.

Ms Herzog thanked Steering Committee members for their constructive and positive contributions and willingness to support GRDC. As chair, she closed the 14th GRDC Steering Committee Meeting at 12:50 after a group photo was taken.

ANNEX I Agenda

Thursday, 1 July 2021

Time (CEST)	Topic	Presenter
08:45 – 09:00	1. Login and testing of communication tools	All
09:00 - 10:15	2. Opening, Introduction, Background and feedback • Welcome and Opening of 14th 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 status of hydrology in the new WMO structure and feedback from EC-73 ○ Role of data centres under auspices of WMO	 BfG Management Ms P Herzog All Ms P Herzog Ms P Herzog D Bérod (WMO)
10:15 - 11:15	3. Contributions and Feedback on GRDC key activities and status report • Overview GRDC and its network • Data acquisition • Introduction new data products • GRDC Database and Download Portal • GRDC client support and data request statistics • GRDC Fresh Water Fluxes to the World's Oceans • GRDC data product development	 U Looser H Plessow T Recknagel
11:15 – 11:30	Health Break	
11:30 - 12:20	4. Brief contributions from participating parties (voluntarily) and General Discussion	All
12:20 – 12:30	5. Date of next Meeting, any other business and Closure	All, Ms P Herzog

ANNEX II List of Participants

Name	Affiliation	Email
Herzog, Petra	Chair: GRDC Steering Committee	Herzog@bafg.de
Berod, Dominique	WMO, Infrastructure Department	dberod@wmo.int
Mishra, Anil	UNESCO-IHP	a.mishra@unesco.org;
Cudennec, Christophe	IAHS, Secretary - General	christophe.cudennec@agrocampus-ouest.fr
Eggleston, Simon	GCOS	seggleston@wmo.int
Mahé, Gil	FRIEND-Water, IRD	gilmahe@hotmail.com
Dietrich, Stephan	EURO-FRIEND-Water & GTN-H	Dietrich@bafg.de
Tramblay, Yves	Hydro Sciences Montpellier	yves.tramblay@umontpellier.fr
Ogilvie, Andrew	IRD Dakar	andrew.ogilvie@ird.fr
Cripe, Douglas	GEO Secretariat	dcripe@geosec.org
Franziskakis, Florian	GEO Secretariat	ffranziskakis@geosec.org
Markus Ziese	GPCC	Markus.Ziese@dwd.de
Kukuric, Neno	IGRAC	neno.kukuric@un-igrac.org
Saile, Philipp	GEMStat	Saile@bafg.de
Busskamp, Ralf	BfG	Busskamp@bafg.de
Dornblut, Irina	GRDC	Dornblut@bafg.de
Plessow, Henning	GRDC	Plessow@bafg.de
Recknagel, Thomas	GRDC	Recknagel@bafg.de
Looser, Ulrich	GRDC	Looser@bafg.de

ANNEX III Acronyms

AI	Artificial Intelligence
BfG	Bundesanstalt für Gewässerkunde (Federal Institute of Hydrology)
CEST	Central European Summer Time
CHy	Commission for Hydrology (WMO)
DCPC	Data Collection or Production Centre
DWD	Deutscher Wetterdienst
EC-73	Seventy-third session of the WMO Executive Council
ECV	Essential Climate Variable
FRIEND-Water	Flow Regimes from International Experimental and Network Data Sets
GCOS	Global Climate Observing System
GEMStat	Global Water Quality Database of GEMS/Water
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GEWEX	Global Water and Energy Exchanges Project
GISC	Global Information System Centre of WMO
GIWA	UNEP Global International Waters Assessment
GPCC	Global Precipitation Climatology Centre
GRDB	Global Runoff Database
GRDC	Global Runoff Data Centre
GTN-H	Global Terrestrial Network – Hydrology
HYDROLARE	International Data Centre on the Hydrology of Lakes and Reservoirs
HydroSOS	WMO Hydrological Status and Outlook System
IAHS	International Association of Hydrological Sciences
ICWRGC	International Centre for Water Resources and Global Change
IGRAC	International Groundwater Resources Assessment Centre
INFCOM	WMO Infrastructure Commission
IoT	Internet of Things
IRD	L'Institut de recherche pour le développement
ISI	UNESCO-IHP International Sediment Initiative
ISMN	International Soil Moisture Network
IT	Information Technology
NetCDF	Network Common Data Form
OSCAR	Observing System Capability Analysis and Review Tool
R-Studio	Programming language for statistical computing and graphics
SC	GRDC Steering Committee
SDG	Sustainable Development Goals
TOPC	Terrestrial Observation Panel for Climate
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO-IHP	UNESCO Intergovernmental Hydrological Programme
WaterGAP	Global freshwater model

WaterML 2.0	Water Markup Language 2.0
WHOS	WMO Hydrological Observing System
WHYCOS	World Hydrological Cycle Observation System
WIGOS	WMO Integrated Observing System
WIS	WMO Information System
WMO	World Meteorological Organization
WMO HydroHub	Global Hydrometry Support Facility
WWDI	World Water Data Initiative
ZRXP	Text-based format for time series developed by Kisters