Convention on the Protection and Use of Transboundary Watercourses and International Lakes

Expert meeting on good practices and lessons learned in transboundary data sharing
First meeting
Geneva, April 2023

Good practices and lessons learned in transboundary data sharing

(First draft, not to be cited)

Summary and proposed action

At its ninth session (Geneva, 29 September – 1 October 2021) the Meeting of the Parties to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) entrusted the Working Group on Monitoring and Assessment to collect good practices and lessons learned in transboundary data exchange and synthesize them in a publication, as part of the activities foreseen in the programme of work for 2022–2024 for *Programme area 2: Supporting monitoring, assessment and information sharing in transboundary basins* (ECE/MP.WAT/63/Add.1, forthcoming).

The Fourth joint meeting of the Working Groups on Integrated Water Resources Management (IWRM) and on Monitoring and Assessment (Tallinn, 28–30 June 2022) approved the outline of the new publication "Good practices and lessons learned in transboundary data exchange" (ECE.MP.WAT/WG.1/2022/INF.3-ECE/MP.WAT/WG.2/2022/INF.3), including the template for case studies.

Subsequently, over 45 case studies for the new publication were received by the secretariat. The purpose of the case studies is to illustrate real life examples, including both the difficulties and challenges countries face and good solutions and ways of organization that countries and joint bodies have found useful. In addition, several case studies were developed following the Regional Workshop on Monitoring, Assessment and Information Sharing in Transboundary Basins in Central Asia (Astana, 1–2 February 2023). Based on the case studies received, the secretariat with support of the lead expert and in consultation with lead Parties, has developed the present first draft.

The Expert meeting is invited to contribute to the development of the publication on the basis of the present draft. The Expert meeting participants will:

- Provide feedback on the structure and text of the draft;

- Comment on the proposed lessons learned and identify additional ones;

- Comment on the proposed case studies and identify new case studies based on their experience;

- Commit to develop additional lessons learned and case studies and submit them to the secretariat for integration in the next draft of the publication.

The work of the Expert meeting and subsequent follow up would enable the submission of the draft publication for review by the 18th meeting of the Working Group on Monitoring and Assessment (Geneva, 17–18 October 2023).

Key messages

Overview of the key messages

1. Introduction

Background of the publication, its target audience and how it was developed. The focus of the publication is on the data and information exchange – both regular but also in cases of emergencies and related to planned measures (activities). Nevertheless, general monitoring aspects can be reflected since monitoring is a precondition for exchange of some data and choices made in monitoring can be decisive for data exchange. The structure of the report will be explained.

Brief overview of the principles of transboundary monitoring and assessment and different lessons about the overall monitoring.

Some ideas to be reflected:

Good water governance and water management need timely, targeted, relevant, sufficient, and reliable data! It is necessary to create common conceptual understanding.

Be pragmatic and focused. Start with most important aspects/indicators → gain routine → extend scope (depending on staff and budget capacities).

Considering data/information exchange as a key instrument for an effective transboundary water resource management

Technical attention is necessary, but it is not sufficient, strong political will must be manifested in political decisions for stability and solidarity between the countries. The inclusion of target 6.5 in the SDGs may help consolidate political will.

Water management requires cooperation; all stakeholders should organize themselves around the issues at stake and start interacting. But the different stakeholders have different values, different biases, different preferences, different cultural perspectives, in short: different mind frames. True interaction can for that reason only be achieved when the actors are aware of the existence of different mind frames and are convinced of the value of the inputs and stakes of the other actors.

Leadership

Some of the key benefits of regular and planned monitoring are:

- It enables assessment of the current state of water quality and trends over time
- It enables compliance with national / international targets and guidelines to be assessed
- It can identify actual and emerging problems of water pollution
- It can enable estimation of the flux of substances from rivers to oceans
- It can provide rapid assessment of the impacts of an environmental incident (e.g., chemical spill) on a water body
- It provides robust information for the development and implementation of water quality management plans and the setting of priorities for POMs
- It enables evaluation of the effectiveness of management and remediation activities
- It provides information on the efficiency of operational activities

Water monitoring programmes with a robust and representative sample collection design are essential for accurate characterization of water quality in order to inform the sustainable management of water resources. https://unece.org/fileadmin/DAM/env/water/meetings/2019/2-4_July_Ohrid/PW_Networks.pdf

2. The monitoring and assessment context

In the pursuit of sustainable integrated water resources management, we should not emphasize the differences between institutions and countries, but we should commit to find common ground and

emphasize the similarities. Experiences show that joint study trips, samplings, workshops, and discussions bring the co-operating people closer together within the countries as well as internationally,

Lesson XX. Ensure clear mandates for data sharing at bilateral/basin level. The basic obligation of riparian countries to exchange and share data and information needs to be stipulated in intergovernmental agreements on transboundary water cooperation at bilateral and/or basin level to provide the mandate for national institutions to exchange information and for joint bodies to collect, process and disseminate such information. The exchange data and information can be further specified in other technical documents such as monitoring programmes, technical regulations on information or data exchange, and statutes and regulations of joint bodies or their working groups.

Case study XX. Legal frameworks for data and information exchange in the Aral Sea basin

For over 30 years, five Central Asian states of the Aral Sea basin (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) cooperate in the framework of the regional organization - International Fund for Saving the Aral Sea, and its institutions – the Interstate Commission for Water Coordination of Central Asia (ICWC) and the Interstate Commission for Sustainable Development of Central Asia (ICSD). Main institutions for data exchange are the Basin Water Management Organizations "Amu Darya" and "Syr Darya" and the Scientific and Information Centre of ICWC (SIC ICWC).

Provisions on information exchange have been included in the constituent documents of regional organizations such as the intergovernmental Agreement on Cooperation in the Field of Joint Management on Utilization and Protection of Water Resources from Interstate Sources (1992) and the Statute of the ICWC (1992, revised in 2008). They were further detailed through decisions of ICWC. In 2005, the ICWC adopted Temporary Rules for the Use of the Regional Information System on Water and Land Resources of the Aral Sea Basin. IN 2014 ICWC approved the Concept Document on the Development of an Information Network on Water Management in Central Asia. The later describes a step-by-step approach to develop databases and information systems at the national, basin, and regional levels, while relying on existing resources and infrastructure.

Source: Scientific and Information Centre of the Interstate Commission for Water Coordination of Central Asia, case study No. 41.

Lesson XX. Involve decision-makers in identifying the information needs from the beginning to ensure that the process is integrated with policymaking processes. Involvement of decision-makers is important to ensure that the resulting information is relevant for decision-making.

Case study XX. River Plata Basin

The River Plata Basin is shared between Argentina, Bolivia, Brazil, Paraguay, and Uruguay. The cooperation is done through the Intergovernmental Coordinating Committee of the La Plata Basin Countries (CIC CdP). The agreement between the governments is based on the La Plata Basin Treaty of 1969 [1], which creates the CIC Cuenca del Plata International organization, in the current Statute updated in 2001 [2], and the Internal Regulations updated in 2002 [3], which define the governance and operating rules of the organization.

The exchange of information is carried out voluntarily by the institutions responsible for information related to the waters of each country. Beyond this, the CIC CdP is implementing a Support System for Decision Making (SSTD) that allows the visualization and processing of information from different countries in a single interoperable platform (Delft-FEWS) within the framework of the project for the

[1] https://cicplata.org/es/documentos/#1481142093532-099e3504-55cd
[2] https://cicplata.org/es/documentos/#1481159972214-a3dab81d-4760
[3] https://cicplata.org/es/documentos/#1481159970877-815b56d0-d69f

implementation of the CIC Strategic Action Plan [4], financed by the GEF. The stable operation of the CIC CdP is financed with contributions from the 5 countries.

The data is automatically integrated online into a common database on the configured Delft-Fews platform. The institutions of the countries are the ones that make the data available for their country, and the ones that use the information system of the entire basin. These institutions are in charge of keeping the monitoring stations active, and the configurations made. The CIC is the institution that hosts the system and is in charge of its maintenance, and coordination for the operation of the system, as well as for possible new developments, training and knowledge transfer.

The system update frequency depends on the data update frequency of each country. Hydrometeorological data is updated frequently, which varies between one hour and one day. Depending on the update of the data of each country. Water quality data is updated on a monthly basis.

Data stored in national databases are temporarily centralized in a common database, the SSTD database. They are accessible to the public, and are easy to find and interoperable, but they are not yet reusable by downloading them.

For the time being there are no joint reports, however periodic reports are expected to be made in the medium term.

The developed system has the objective of supporting decision-making by the decision-makers of each country who have also participated in its configuration. At this stage, the SSTD is mainly developed for expert technical users from the different countries, who, depending on the communication and decision-making strategy of each country, can use the SSTD as an additional input for decision-making.

The platform for public access is not yet available, its access on the web is foreseen as of December 2022, inserting the dashboard on the CIC Cuenca del Plata website (https://cicplata.org/es/)

Lesson XX. Financial arrangements can be a mixture of different sources. Especially the improvement of a network and development of new methods or hardware can be supported from external sources. The overall running of the monitoring network is most secure when it is financed from domestic sources.

Case study XX. The Sava River Basin

The Sava River Basin is shared between Slovenia, Croatia, Bosna and Herzegovina, Serbia, Montenegro, and a small part of northern Albania. The Policy on the Exchange of Hydrological and Meteorological Data and Information in the Sava River Basin describes the mandate for the cooperation.

Improvement of the monitoring network and new software and hardware is financed by World Bank, GEF, SCCF and other donors. Maintenance of the system is mainly supported by the riparian countries.

Monitoring data of the environmental conditions of transboundary waters are exchanged as well as measures taken and planned, national regulations and critical situations (emerging floods and droughts). Data is exchanged on a daily basis to both joint and national databases. Decision-makers are informed through yearly hydrometeorological reports.

Source:

Lesson XX. Create a specific working group responsible for monitoring as part of a joint commission's institutional framework. A specific working group on monitoring with the necessary technical capabilities can make the specific technical arrangements needed. This helps to avoid political discussions. The working group nevertheless needs an appropriate mandate to fulfil its tasks. This also holds true for having a general

[4] "preparando las bases para la implementación del Programa de Acción Estratégica (PAE) de la Cuenca del Plata" https://cicplata.org/es/proyecto-implementacion-pae/

mandate to share information and specific agreements of the types of information to be shared and how this will be shared.

Case study XX. Senegalo-Mauritanian Aquifer Basin (SMAB)

The Senegalo-Mauritanian Aquifer Basin (SMAB) is shared between Gambia, Guinea Bissau, Mauritania and Senegal. As part of its accession process to the Water Convention, Senegal requested support for the development of a cooperation initiative on the aquifer and deepening the knowledge on the aquifer. The Regional Working Group for Transboundary Cooperation on the SMAB was established with the support from the Water Convention Secretariat in April 2020, bringing together four governments, the Organization for the Development of the Gambia River and the Organization for the Development of the Senegal River. The Department of Water Resources (DWR) in Gambia, the General Directorate of Water Resources (Direção Geral de Recursos Hídricos, DGRH) of Guinea-Bissau, the National Centre of Water Resources (Centre National des Ressources en Eau, CNRE) in Mauritania and the Directorate of Water Resources Management and Planning (Direction de Gestion et de Planification des Ressources en Eau, DGPRE) of Senegal are responsible for the data and information sharing. Focal persons from these four institutions form part of the Regional Working Group, a body mandated to exchange data and advance cooperation between the four countries in terms of groundwater management in the Senegalo-Mauritanian Aquifer Basin.

Cooperation under the Regional Working Group allowed strengthening the understanding of the aquifer characteristics and development of joint vision. In September 2021, the ministers in charge of water in the four countries have signed a declaration in which they committed to establishing a legal and institutional framework for cooperation for the sustainable management of the SMAB and charged the Regional Working Group to enable the exchange of data on the SMAB. External funding is sought to finance the activities planned by the Regional Working Group, including the exchange of data.

Source:

Case study XX. The Mozambique Zimbabwe Joint Water Commission

The Mandate is included in Mozambique-Zimbabwe Joint Water Commission that the two countries will exchange data and information on water resources. The frequency and type as well as quality of data to be shared is not well defined in the Joint Water Commission Agreement. However, the two countries have signed Water Sharing Agreements on the Pungwe (2016), Buzi River (2019) and now they are finalizing the Save Water Sharing Agreements. In these agreements, there is an annex on data sharing. Further to that, the two countries with support from GEF BUPUSA project have developed a data sharing protocol called 'Rules and Procedures between the Republic of Zimbabwe and the Republic of Mozambique on the Sharing of Data and Information Related to the Development and Management of the Buzi, Pungwe and Save Watercourses' The data Sharing protocol has been approved by the Joint Water commission but will come into force once it has been signed by the Ministers responsible for water from both countries.

Currently the responsibility of financing data collection lies with member states. In Zimbabwe there is cost recovery for data by selling data to the public as well as other institutions. This however does not apply where data is being shared by riparian countries. In Mozambique there is an MoU between the Water institutions and the meteorological institutions for free access to data. Hydrological/water quality data is available for free.

Source:

Lesson XX. Use existing RBO and non-RBO institutions and mechanisms for transboundary cooperation to the extent possible. Where there is a mechanism for cooperation, either formalised or informal, such a mechanism can be used to extend and improve the cooperation. (Also see the case study on the Transboundary aquifers along the Mexico-U.S. border and Kazakhstan-Uzbekistan Working Group on Environmental Protection and Water Quality in the Syr Darya River Basin)

Case study XX. The Organization for the Development of the Gambia River (OMVG)

The Organization for the Development of the Gambia River (OMVG) is sub-regional comprising four member countries, namely, Gambia, Guinea, Guinea-Bissau and Senegal. It was created on June 30, 1978, by Gambia and Senegal for the development of the resources of the Gambia River. In 1981 and 1983 the Republics of Guinea and Guinea-Bissau respectively joined the organization. Following these memberships, in 1987, the competences of the OMVG were extended to the watersheds of the Kayanga/Géba and Koliba/Corubal rivers.

The High Commission of the OMVG is the executing organ of the integrated development programs of the four member countries for a rational and harmonious exploitation of the common resources of the basins of the Gambia, Kayanga-Géba and Koliba-Corubal rivers. To this end, the High Commission is responsible for collecting basic data concerning the three rivers under its jurisdiction on the territories of the Member States.

Source:

Lesson XX. Ensure political support for the monitoring system.

Lesson XX. Demonstrate the benefits of basin-wide cooperation in monitoring.

Lesson XX. Give a mandate to river basin organizations to overlook transboundary monitoring.

Lesson XX. Ensure an integrated approach for the monitoring system.

Lesson XX. Facilitate trust building and collaborative learning.

Lesson XX. Apply transparency and openness throughout the process.

Lesson XX. Identify the needs for capacity development.

Lesson XX. Develop a capacity-development plan.

Lesson XX. Joint meetings

Lesson XX. Formal and informal cooperation supported by institutions

Lesson XX. Engage key parties including private party (hydropower operators)

Lesson XX. More focus on groundwater

Lesson XX. Need for a phased, step-by-step approach

Case study XX. Activities of the Kazakhstan-Uzbekistan Working Group on Environmental Protection and Water Quality in the Syr Darya River Basin

In 1997, the Governments of Kazakhstan and Uzbekistan signed an agreement on cooperation on environmental protection and sustainable environmental management. In 2017, the Governments signed the Strategy for Economic Cooperation for 2017-2019, which included the activities of “creating a joint Commission for cooperation on environmental protection” and “ensuring joint water sampling, analysis, and exchange of water quality data and regulations”. The Joint Working Group on Environmental Protection and Water Quality in the Syr Darya River Basin was established in 2018.

The Working Group has held meetings, visited relevant laboratories, studied regulatory and technical documentation, made decisions on monitoring and reviewed the activities of stakeholders. In 2019, the Working Group approved a list of indicators to be measured, sites for joint water sampling and the analysis and sharing of results. In 2020, the Parties agreed to review and determine the timing of sampling, taking into account the time for water to travel between sampling points. In 2021, the Parties agreed to promptly notify each other of the occurrence of emergency situations and to perform joint analysis of water samples as well as share experiences of the joint analysis and capacity building.

In 2022, Kazakhstan and Uzbekistan invited representatives from Kyrgyzstan and Tajikistan to participate in the Working Group meeting as observers, as these two countries also share the Syr Darya basin.

Kazakhstan proposed the creation of a joint 4-party working group to deal with water quality in the Syr Darya basin. An interim report on the implementation of the project "Development of Joint Measures to Prevent and Respond to Pollution of the Syr Darya River in Emergency Situations" was presented. The meeting also considered the draft Programme of Measures for the conservation and restoration of the ecosystem of the transboundary Syr Darya River for 2023-2025, which included activities to identify and eliminate sources of pollution on the river.

Since the establishment of the Working Group, Kazakhstan and Uzbekistan have made progress in the implementation of measures aimed at improving the ecosystem of the Syr Darya Basin. However, some challenges remain, such as the differences in the national regulations and standards as well as differences in the physical facilities of monitoring services, since water quality monitoring involves different agencies within each country who use different sampling sites and monitoring frequencies. The Working Group is planning to implement a comprehensive environmental survey of the Syr Darya Basin with the involvement of international organizations. The inclusion of Kyrgyzstan and Tajikistan in the activities on water quality in the Syr Darya river basin represents an important step for the future.

Source: Dana Agybayeva presentation in Astana 1.2.2023

Lesson XX. Pilot projects as useful instruments for a step-by-step-approach

3. Set-up of the data sharing

This chapter describes the lessons learned around the set-up of the data and information exchange; the responsible institution(s), the agreement or mandate that arranges for the data and information exchange as well as more technical documents that specify the (monitoring) data subject to exchange, and the financing mechanism.

Lesson XX. Ensure adequate financing for sharing data. Monitoring requires long-term financing to be able to develop a good joint understanding of the water situation and to discover trends. One approach is to develop a joint monitoring system including the sharing of the data, with financing from different sources including donors. Another approach is to share the data from the respective national monitoring networks. (Case study Meuse and Mozambique Zimbabwe Joint Water Commission are also examples)

Case study XX. OKACOM

The Okavango River basin is shared between Angola, Botswana and Namibia. The countries have statistical agencies, which are the primary national institutions mandated with documenting, storing and distributing national data. With respect to water resources/basin data the institutions are the Gabinete para Administracão das Bacias Hidrográficas do Cunene, Cubango e Cuvelai in Angola, the Department of Water and Sanitation in Botswana, and the Department of Water Affairs in Namibia.

The OKACOM Data Sharing Procedure is the instrument and agreement for data sharing among Member States. Data sharing has been going on for since 2020 based on this agreement. The agreement also led to the establishment of the OKACOM Environmental Monitoring Framework.

Each Member State finances all data collections as per its usual departmental activities. ICPs from time to time also support joint data collection and basin-wide monitoring which contributes greatly to data on ungauged streams.

The data sharing procedures set some quality assurance principles. The OKACOM Decision Support System ensures that data will be stored in a consistent format from all Member States and at the same time provides a platform for harmonization of national databases both in data format, technology and systems used for Hydromet-gauging and data storage.

Source: https://www.okacom.org

Lesson XX. In the absence of a formal agreement, informal cooperation can still take place. Cooperation is necessary for proper management, but it is not always necessary to have a formal agreement. For instance, experts and the academia can decide to share data and information.

Case study XX. Transboundary aquifers along the Mexico-U.S. border

The Binational Groundwater Task Force (BGTF) is part of the Permanent Forum of Binational Waters between Mexico and the United States. The BGTF is composed of members from both countries. There is no agreement, this is an informal effort of experts and academics working together. There is no mandate, everything is discussed and agreed upon by members of the BGTF on a voluntary basis. Also, there is no financial arrangement or money committed to this effort yet. Everything has been based on a voluntary basis. Potential projects have been attracted and funding might come later. In average, the BGTF meets virtually once a month.

Data and relevant information are exchanged using existing reports in PDF formats, digital data files, online access, direct transmission between members, provision of information services, and in some cases, the own production of information by members of the group. There is no protocol on the timing; the exchange is based on activities assigned or required by the members and the expected outcomes. Data is stored in the database of the Permanent Forum of Binational Waters. It will be public once the intended reports are completed.

There are no joint reports yet. The BGTF is working on deliverables that are planned to be ready on a yearly basis. Those deliverables can be distributed to the members of the Permanent Forum of Binational Waters as policy briefs, data production reports, joint publication, etc. The BGTF has yet to decide in which format this information will be shared. The BGTF plans to provide all this very rich analyses with processed data and generated information to governmental and non-governmental institutions, such as the International Boundary Waters Commission - Binational (IBWC) and Comisión Internacional de Limites y Agua (CILA); states and federal governments. Information will be publicly available once it is integrated and reported properly.

Source:

Lesson XX. Develop a transboundary early warning system. Early warning for floods, droughts and pollution events is of high importance for countries to be able to take timely measures. An early warning system is therefore in a transboundary basin of utmost importance.

Case study XX. Georgia

For the basins Mtkvari (Kura), Lori, Alazani, Khrami, Tushetis Alazani (Andis koisu), Asa, Arghuni, Tergi, Debeda, Fockovistskali, and Chorokhi, there is an exchange of critical situations (e.g., emerging floods or droughts, accidental spills) between Georgia, Azerbaijan, Russia, Turkey, and Armenia. There is no official agreement, however, hydrological bulletins for spring runoff for Mtkvari and Alazani River basins is shared with Azerbaijan hydrometeorological service. There is a database (Aquarius) for hydrological (water level, discharge) data. The data is not accessible publicly, but it is interoperable and reusable.

Source:

Lesson XX. Adopt a step-by-step approach to monitoring in the transboundary basin. For instance, a project can be the start of more regular cooperation and sharing of data and information. All work done in the project can act as the basis for further cooperation.

Case study XX. The BIO-PLATEAUX project

On two transboundary watersheds, the Maroni (Suriname and French Guiana) and the Oyapock (French Guiana and Brazil) a cross-border Observatory on water and aquatic biodiversity is being planned. As part of the BIO-PLATEAUX project, which facilitates this prefiguration, the focal points are the French Guiana

Water Office, Anton de Kom University and the Amapa Economic Development Agency. The International Office for Water (OiEau) coordinates joint activities and runs the www.bio-plateaux.org.

The three countries do not have a centralized system with an organization responsible for production and exchange, but a wide variety of producers who exchange their data on water and aquatic environments. To cite just a few key players: in French Guiana: Directorate General for Territories and the Sea (DGTM – government services in French Guiana), and the French Guiana Water Office (OEG). In Brazil: National Water Agency at federal level, IEPA at Amapa State level. In Suriname, the Ministries of Natural Resources, Public Works, Environment or Regional Development.

The focal points of the BIO-PLATEAUX project signed, in the presence of their respective national and territorial authorities, two Declarations promoting data sharing and designating responsibilities in leading the process; the Declaration at the end of the Conference of Cayenne in November 2019, promoting a long-term joint initiative to get to know each other better, to know the water resources and to raise awareness of the issues of the Maroni and Oyapock watersheds, and the Declaration of the partners at the end of the Phase 1 of the project (April 2022), announcing a prefiguration of the cross-border Observatory by 2025. The project is supported by the European Union (INTERREG Amazonia Cooperation Programme), the Territorial Collectivity of French Guiana (CTG), the National Center for Space Studies (CNES), the General Directorate of Territories and the Sea (DGTM), the Office of the 'Eau de Guyane (OEG), and the French Office for Biodiversity (OFB).

The shared data include environmental status monitoring data (quantity/quality of surface water and groundwater) of water in transboundary basins, volumes withdrawn, drinking water and sanitation indicators and metadata of existing data sets. The partners also share documents and studies in a dedicated documentary space.

Implementation of benchmarks are done at the national level. Production of metadata on the various data sets made available with implementation of national metadata catalogues. In the absence of common repositories set up between countries, data harmonization is often done on the fly during automatic import-export procedures using ETL (Extract Transform Load) tools. Data quality control remains the responsibility of data producers, the latter being invited to specify the quality control procedures implemented in their metadata sheets describing the data sets made available. The integration of data into the cross-border platform of the observatory also allows additional quality control through the possibility of cross-analysis between the data made available by the countries.

When the partners have developed information systems, data sharing is mainly done via API, WMS (Web Mapping Services) in a logic of strengthening open data and the interoperability of information systems. Various applications set up at the national level also allow the downloading of data sets. The sharing of reference data and "historical" data is done gradually, subject by subject, via the transmission of files, and/or the implementation of ETL procedures, and/or the provision of web services and/or APIs. The regular updating of the data and the sharing of the data is then done in an automated way via interoperability processes between the information systems of the national producers (and/or the national information IS on water) and the platform of the Observatory. These processes make it possible to consume/harvest the data according to the needs according to the agreements and with variable frequencies which can go from real time to daily/ten-day/monthly/annual frequencies).

The data is archived in the information systems of the data producers, and the establishment of a national (or regional, as the case may be) platform allows the integration and cross-valorisation of the data. The data is primarily stored in the databases of the data producers, who remain responsible for their data, and then possibly in the national information systems. Depending on the needs and authorizations, they can then be integrated into the framework of the Cross-Border Observatory platform. The data and products generated have different levels of access (public, private, restricted by password) depending on the case. Except in specific cases where a producer asks to respect the confidentiality of the data, most of the visualization products produced at the cross-border level are available online, accessible and downloadable by the public.

From the moment the data is integrated into the cross-border platform, it can be used for the production of reports, maps, bulletins, and for online visualization products such as interactive maps, interactive

dashboards. The integrated data must also be able to be made available to partners in the form of web mapping services and/or APIs. In addition, an interactive catalogue of metadata, available online, should allow data consumers to have all the descriptive elements, in particular concerning data traceability and data production and quality control procedures, in order to be able to check whether the available datasets are likely to meet their needs.

Source:

Lesson XX. Ensure collection and sharing of the appropriate and necessary data, information and models for the entire basin and across the water cycle.

Case study XX. Upper Indus Basin Network (UIBN)

The International Center for Integrated Mountain Development (ICIMOD) is an inter-governmental knowledge center working in the Hindukush Himalayan (HKH) region shared by eight member countries. ICIMOD has established platforms like the Upper Indus Basin Network (UIBN). UIBN is a voluntary and neutral knowledge and research network of key stakeholders of the riparian countries who share the Indus basin, including Afghanistan, China, India, and Pakistan. The network aims to bring together the relevant government, institutions, policy champions, development organizations, researchers, and academic institutions to collaborate and share new knowledge, experiences, challenges, and solutions, related to climate, cryosphere, water, hazards and vulnerability, and adaptation. Its emphasis on data sharing and its importance but given the geopolitical sensitivities in the region, data sharing is not happening, but the focus is more on knowledge and information exchange. The network has its country chapters in all the riparian countries who meet periodically at the national level as well as at the regional level. The country chapters bring together diverse institutional members working in the upper Indus basin. The country chapters are headed by relevant government institutions like, Afghanistan National Water and Environment Research Centre (ANWERC), Yunnan University, China, Indian Institute of Geomagnetism, Mumbai, India, and Pakistan Council of Research in Water Resources (PCRWR). Among many other institutions involved in the network and contribute to information and data exchange are the Ministry of Energy and Water, Afghanistan, Chinese Academy of Sciences, Institute of Tibetan Plateau Research, Jawaharlal Nehru University, India, Pakistan Metrological Department, Water and Power Development Authority, Pakistan, and many others. The members from these organizations are nominated by their respective institutions. These member institutions do work together for joint intervention.

Since it is a voluntary and entirely a neutral knowledge and research network, there is no formal agreement signed amongst the parties engaged. However, the forum has been established by the members with mutual consensus. The members have agreed on the scope of the network defining ten guiding questions, based on which the member countries would generate and share knowledge. The network has developed and endorsed a governance framework, that defines the purpose of the network, governance structure, scope, roles and responsibilities, meetings, and reporting mechanisms. The regional forum has also devised a theory of change, defining the long-, medium- and short-term outcomes and pathways to get to these outcomes.

Initially, ICIMOD is coordinating and supporting the network with resources including finance to arrange meetings at the regional level whereas the country chapters are organizing the periodic country chapter meetings by themselves. International researchers working in the region, who provide valuable contributions on knowledge and information exchange, cover their own expenses to participate in the meetings. Relevant country chapters are expected to mobilize resources for any collaborative research interventions with other country chapter. The country chapters are discussing opportunities for joint funding proposals to support knowledge development catering to the regional knowledge gapes. ICIMOD is providing some funds for a few collaborative research interventions in India and Pakistan. The India and Pakistan country chapters are collecting the field data based on the standard data collection tool developed by ICIMOD. The study reports and research papers generated from these studies will be published jointly by both the country chapters and ICIMOD.

The country chapters have been formed based on six thematic working groups (TWGs) who consolidate, synthesis and exchange knowledge on their relevant TWGs. These groups include:

Group 1: Framework of data collection, quality, and standardization

Group 2: Climate change, air pollution variability and black carbon

Group 3: Cryosphere monitoring and modelling

Group 4: Surface and groundwater hydrology, water availability and demand

Group 5: Understanding and managing hazards and risks

Group 6: Managing gendered socioeconomic impacts through adaptation measures

The Theory of Change (ToC) works as a guiding tool for the country chapters to keep their focus aligned to each other. Secondly, the ten standard guiding questions set by UIBN helps the country chapter and TWGs focus synchronized. The knowledge exchanged during the periodic meetings, standard presentation templates with guiding notes are provided to the country chapter leads to ensure comparable and standardized knowledge and experience sharing. There is also a standard reporting template for all the country chapters to document their experiences and progress.

For the two collaborative studies between UIBN India and Pakistan chapter, ICIMOD anchors the development of a standard data collection tool for enumerators, and their training materials for data collection, data analysis and drafting reports, to ensure comparable and quality. The country chapters also collect data based on the standardized tools from the field.

Considering the sensitive geopolitical situation among and between the Indus basin riparian countries, data sharing presents itself as one of the most challenging parts of the network. In order to pave a way for stakeholders to share data and information with one another, a platform for discussions on shared challenges, existing knowledge, and potential for collaborative research interventions is imperative. This is also crucial for building trust and confidence among one another. UIBN is one such platform where members share their experiences, new relevant knowledge and discuss challenges and potential solutions. The UIBN country chapters meet at least twice in a year to share their country chapter progress through standardized power point presentations. The discussions and presentations are then documented in the form of meeting proceedings.

The information and knowledge sharing takes place during the network's periodic meetings- twice a year. In addition, experience and knowledge sharing among the country chapters at the national level occurs on a more frequent basis – once every few months. For any other specific collaborative or joint research interventions, the frequency may be different depending upon nature of the research and the research duration.

The new research findings and knowledge as well as country chapter progress are presented in the regional UIBN meetings, and these presentations are further elaborated in the form of meeting proceedings. These proceedings are then shared on ICIMOD's web portal open for public to refer to. The data generated from the collaborative research studies are being used for publications and these publications are open access journal articles. Whereas the data sets generated from the Sustain Indus initiative are hosted on IKPP which has open access for public.

The knowledge and experiences shared in the UIBN forum are documented in the form of event proceedings as well as articles, bulletins and news and shared with the members. It entails all the new knowledge, research findings, country chapter progress, experiences, challenges, and solutions. In addition, the UIBN members who are affiliated with relevant government and non-government institutions, academia, and other policy relevant professionals in the UIBN are expected to utilize learnings and feedback from the discussions in their relevant institutional programs and policies etc.

The collaborative research studies are published in the form of assessment reports and open access journal articles and disseminated to wider audience for use.

Source:

Lesson XX. Raise awareness of the importance of acting at a basin-wide scale.

Lesson XX. Agreement should not be limiting

Lesson XX. Inter-agency cooperation programs can support cooperation in a more flexible way. Developing inter-agency cooperation programs in support of intergovernmental agreements or even without such agreements may provide flexible instruments for cooperation. Such programs can be concluded for shorter periods of time and allow for adjustments when prolonged/revised for a new period.

Case study XX. Cooperation through inter-agency programs between hydromets in Central Asia

In the region of Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) there are bilateral cooperation programs between hydrometeorological services, typically concluded for a period of three years and renewed afterwards. These bilateral programs define the type, timing, frequency and method of transfer of information. They cover the exchange of actual meteorological, hydrological, and agrometeorological information and the exchange of information products such as weather forecasts, forecasts of water volumes, forecasts of reservoir volumes, warnings on extreme hydrometeorological situations, exchange of bulletins and reports. In addition to regular exchange of data and forecasts, such programs may also cover cooperation in research and development.

For example, Kazhydromet (Kazakhstan) has a program of cooperation with Uzhydromet (Uzbekistan) which is renewed every three years. On a daily basis, these agencies exchange hydrological information on 23 stations in the territory of Uzbekistan and 12 stations in the territory of Kazakhstan. Daily exchange covers water level and water flow in the rivers, ice drifts, data on river tributaries, as well as reservoir volumes and discharge. Every three months the agencies exchange information on forecasted flow in the Amydarya and Syrdarya basins. Each February, Uzhydromet provides Kazhydromet with preliminary forecasts of water flow in the Amydarya and Syrdarya basins for the upcoming vegetation period (from April to September). Every March, Uzhydromet provides Kazhydromet with the updated forecasts of water flow in the Amydarya and Syrdarya basins for the vegetation period.

Similar programmes exist between Kazhydromet and Kyrgyzhydromet (Kyrgyzstan), and between Kazhydromet and Tajikhydromet (Tajikistan). In addition, Kazhydromet has a three-year bilateral program with Roshydromet (Russian Federation), covering daily exchange of hydrological data at transboundary rivers and volumes of reservoirs, as well as hydrological forecasts.

Exchange of data on water quality is gradually developing in the region, particular between Kazakhstan and Uzbekistan in the Syrdarya River basin (since September 2018) and between Kazakhstan and Kyrgyzstan in the Chu and Talas River basins. Major challenges include harmonising the methods for collection and analyses of water quality information.

Exchange of hydrochemical data between Kazakhstan and the Russian Federation takes place on a regular basis for Irtysh, Yesil, Tobol, Ural/Zhaiyk, Karaozen, Saryozen, and Kigach river basins.

Source: Rauza Aschanova (Kazhydromet), presentation “Hydrological monitoring and water quality regulation system in Kazakhstan, Rauza Aschanova”, February 2023.

4. Types of data and information shared

This chapter describes the lessons learned around the types of data and information that are shared as well as the role of international standards in the data-exchange. This may be about the types of data exchanged in general, but also what types of data may be more difficult to exchange, etc.

Lesson XX. Exchange data and information in critical situations, e.g. floods, droughts, or industrial and other accidents. This may include increased frequency of exchange, additional categories of data to be exchanged, specific national authorities to be involved, etc. Timely provision of information in critical

situations reduces transboundary impact, saving lives, preventing environmental damage or reducing pollution.

Case study XX. Emergency pollution of transboundary waters shared by Moldova and Ukraine

Moldova and Ukraine share the Dniester and the Prut Rivers. They cooperate based on the intergovernmental Agreement on the joint use and protection of transboundary waters (1994) and the Treaty on Cooperation in the Field of Protection and Sustainable Development of the Dniester River Basin (2012). The Regulation on the assessment of the quality of transboundary waters ensures regular exchange of information on the quality of border waters. The two countries have agreed on state (national) monitoring programs and methods for evaluating results, to the extent necessary to obtain comparable measurement data on water quality indicators, on the basis of which it is possible to jointly assess the quality of border waters and trends in its change. The monitoring program for the quality of border waters includes monitoring sites and corresponding sampling points (gauges), sampling frequency, and analyzed water quality indicators.

In the event of emergency pollution of transboundary waters, there are additional requirements to monitoring and exchange of data and information. These are defined in the Regulation on actions during emergency pollution at transboundary rivers. In the event of emergency pollution, the Party where pollution originates has to immediately notify the other Party. In addition, Parties have to:

- Carry out additional water sampling and measuring of quality indicators;

- Exchange operational information on the volumes of discharge of pollutants;

- Timely provide information on changes in the quality of transboundary waters;

- Analyze the situation, develop an action plan to stop pollution and eliminate its consequences.

Source: https://dniester-commission.com/ and Environmental Protection Agency of Moldova, case study No. 42.

Lesson XX. Establish a joint working group to discuss about the data to collect and share. Agreement needs to be reached about the data to collect, and this is an iterative process that needs to be done regularly. By establishing a working group to decide about which data to collect where, and the work can be done in a targeted way. The proposed data collection can subsequently be agreed upon by the decisionmakers.

Case study XX. International Meuse Commission

The Meuse River basin is shared between France, Luxembourg, Belgium, Germany, and the Netherlands. International Meuse Agreement signed in 2002: the Contracting parties shall cooperate "in coordinating the implementation of the requirements of the Water Framework Directive to achieve the environmental objectives it sets out and, in particular, in coordinating all programmes of measures for the International River Basin District Meuse", "in part by means of preventive measures – to reduce the impact of floods and droughts", and "in consulting each other and then coordinating preventive and protective measures against floods, giving consideration to ecological aspects, regional planning, landscape conservation and other fields such as agriculture, forestry and urban development". "The implementation of the requirements of the Water Framework Directive shall be coordinated multilaterally within the Commission. In particular, this shall involve the coordination of:

a) the analysis of the characteristics of the International River Basin District Meuse;

b) the investigation of the impact of human activities on the status of surface waters and groundwater in the International River Basin District Meuse;

c) the economic analysis of water use;

d) monitoring programmes; and

e) the exchange of information between operational centres.

An agreement on data exchange and flood forecasting within the Meuse IRBD was signed on 9th December 2016 entailing the mutual and continuous exchange of hydrological data and forecasts (water levels, flows) between the services. There is no charge for the exchanges and no additional costs for the services.

The way to calculate the average discharge on 7 days was discussed and validated in the Working Group Hydrology of the IMC. The delegations also agreed on the most relevant stations to be included in the low water notice and on the text, tables and map within the document. Within the Homogeneous Measurement Network (39 stations), delegations have agreed to follow 55 parameters at the same frequency, with the same analytical method and the same standards. The secretariat is in charge of collecting the data every Monday, updating the low water notice and publish it on the IMC website.

Each delegation is using its own data to evaluate the low water level in its part of the basin so that public authorities and decision makers can take appropriate measures concerning water uses. However, the IMC's low water notice gives an overview of the situation in the whole basin so that downstream countries can prepare themselves regarding the situation upstream.

Source: http://www.meuse-maas.be/Accueil/La-commission-internationale-de-la-Meuse.aspx?lang=en-US

Lesson XX. Share data and information beyond hydrological and water quality data. For informed decision-making, data and information is needed on, among others, sources of problems and effectiveness of measures. It is recommended to collect and share data and information along the lines of the Driving force – Pressure – State – impact – Response (DPSIR) framework. (Also see Sava case)

Case study XX. Sharing of information between Chile and Argentina

Chile and Argentina share information on the transboundary basins Río Valdivia, Río Puelo and Río Baker. In 1991, Chile and Argentina signed the Environmental Treaty and the Additional Specific Protocol on Shared Water Resources. The Protocol establishes a Working Group within the framework of the Environment Subcommittee, a body that in turn is part of the Chilean-Argentine Binational Commission (Art. 12 of the 1984 Peace and Friendship Treaty).

Article III of the Treaty, on "Means", provides the following: "Exchange of technical-scientific information, documentation and joint research".

For its part, Article 8 of the Protocol indicates: "(...) the execution of the actions and programs referred to in this Protocol will be carried out, mainly, through:

a) Exchange of legal, institutional, technical-scientific information, documentation and research.

b) Organization of seminars, symposiums and bilateral meetings of scientists, technicians and experts."

On the other hand, in its Article 5, the Protocol establishes that the General Use Plans (PGU) are the management instrument agreed between the countries for a shared and integrated management of water resources.

Each country delivers the information prepared by its agencies and institutions, within the framework of its annual budget item. There are no financial or budgetary obligations between the countries.

In 2019, both countries exchanged spatial information including: political-administrative limits, the delimitation of hydrographic basins, basin hydrography, location of glaciers and protected natural areas; as well as the location of meteorological, fluviometric, water quality and glaciological stations.

The information exchanged between both countries is intended to build an atlas of the basins shared between Chile and Argentina and, specifically, to have fundamental and basic information to reach an agreement on a General Utilization Plan (PGU) for each prioritized basin.

Source:

Case study XX. Buzi, Pungwe and Save Basins: The Bupusa Data Sharing Protocol

The Buzi, Pungwe, and Save Transboundary River Basins are shared by Mozambique and Zimbabwe. The Mozambique Zimbabwe Joint Water Commission is supported from Departments Responsible for Water Resources Management in both countries and their basin authorities namely ARA Centro, ARA Sul (in Mozambique), ZINWA Head Office, ZINWA Save and Zinwa Runde (Zimbabwe). The mandate for data sharing is included in Mozambique-Zimbabwe Joint Water Commission. The frequency and type as well as quality of data to be shared is not well defined in the Joint Water Commission Agreement. However, the two countries have signed Water Sharing Agreements on the Pungwe (2016), Buzi River (2019) and now they are finalizing the Save Water Sharing Agreements. In these agreements, there is an annex on data sharing. Further to that, the two countries with support from GEF BUPUSA project have developed a data sharing protocol called 'Rules and Procedures between the Republic of Zimbabwe and the Republic of Mozambique on the Sharing of Data and Information Related to the Development and Management of the Buzi, Pungwe and Save Watercourses'. The data Sharing protocol has been approved by the Joint Water commission but will come into force once it has been signed by the Ministers responsible for water from both countries.

Currently, the responsibility of financing the data collection lies with the member states. However, in the case of Zimbabwe, they do cost recovery for data and therefore they sell data to the public as well as other institutions. This however does not apply where data is being shared by riparian countries. In the case of Mozambique there is an MoU between the Water institutions and the meteorological institutions for free access to data. Hydrological/water quality data is available for free

Data sharing includes:

a) 1. Hydrology; 2) Hydrogeology; 3) Climatology; 4) Meteorology; 5) Water quality; 6) Socio-economy; 7) Environment; and 8) Planning Instruments.

b) In the draft Data Sharing protocol, the two countries have agreed to share information on the best available technology.

c) Results of relevant research and development are included in the protocol.

d) Emission data of pollutants and wastewater is confined to water quality as well as pollution threats.

e) Potential planned measures have been identified and are included in the signed water sharing agreements. In the agreements member states are also required to notify each other on new planned measures that are to be undertaken. The member states are supposed to notify the other party well in advance.

f) National regulations are included in the information to be shared.

h) Critical situations (e.g., emerging floods or droughts, accidental spills are included in the data sharing Protocol. There is an emphasis on emergencies e.g. pollution spillage, floods occurrences.

The Data Sharing protocol promotes harmonization of data collection, processing and storage. A central repository of information BUPUSAWIS Buzi Pungwe, Save Water Resources information system is planned. Currently data is exchanged though weekly bulletins by email. BUPUSA WhatsApp group has been formed and on a daily basis information is exchanged particularly during time of rainy season. The exchange of information has now been regularized in the Data Sharing protocol. During the wet season data exchange is daily for areas where there is high potential of flooding but less frequent during the dry season. Some key hydrological stations on the three transboundary rivers in both countries are being upgraded so as to transmit data on Real time. The data exchange ranges from 15 min interval to 1 hour

Currently each country has its own database, but plans are to set up the BUPUSAWIS which will be available as a central data base. Both countries have agreed that there will be different levels of access to data.

Decision makers receive weekly reports.

The water authorities have websites where information is published. In the case of Mozambique, a weekly bulletin is published. In Zimbabwe dam levels are published on weekly basis. In both countries information is also share information through TV/radios

Source:

Case study XX. Transboundary Groundwater Body Karavanke

The Transboundary Groundwater Body Karavanke is shared between Slovenia and Austria. Data sharing takes place within the bilateral working group „Reserves of Drinking Water Karavanke“, which is operating in the frame of the Permanent Slovenian-Austrian Commission for the Drava River, led by the Ministry of the Environment and Spatial Planning of the Republic of Slovenia and the Federal Ministry of Agriculture, Forestry, Regions and Water Management of the Republic of Austria.

Permanent Slovenian-Austrian Commission for the Drava River is based on the Law on the Ratification of the Agreement between the Republic of Slovenia and the Republic of Austria on further validity of the appointed Yugoslav-Austrian Contracts in the relations between the Republic of Slovenia and the Republic of Austria, and the Agreement between the Government of the Republic of Slovenia and the Federal Government of the Republic of Austria on further validity of the appointed Yugoslav-Austrian Contracts in the relations between the Republic of Slovenia and the Republic of Austria on further validity of the appointed Yugoslav-Austrian Contracts in the relations between the Republic of Slovenia and the Republic of Austria (1993).

The data and information exchange is not exclusively financed. Contribution of experts to the working group is in kind, as a part of the activities needed for functioning of the Permanent Slovenian-Austrian Commission for the Drava River.

The data and information are exchanged as needed according to the agenda of the working group “Reserves of Drinking Water in Karavanke”. Below are some examples of data and information exchange between both parties:

a) Monitoring data of the environmental conditions of transboundary waters: Information on groundwater (quantity and quality) monitoring locations together with monitoring specifics (measured parameters, frequency etc.) and data. The groundwater status (quantitative and qualitative) of the common groundwater body is regularly updated.

b) Results of relevant research and development: National hydrogeological findings are regularly discussed such as: unexpected, measured groundwater data, results of recent tracing experiments, new findings in determination of drinking water resources, hydrogeological specifics gained via common nations (tunnel excavation across the national border), work progress on relevant international and national projects etc.

c) Measures taken and planned are discussed such as the new concept presentation for water supply in municipalities within common groundwater body

d) National regulations: The national legislations are discussed and translated with the aim to meet the common protection of groundwater resources which flow across the national border (water protection zones delineation).

e) Permits: Information on recent granted water rights is regularly updated.

The parties follow ISO standards for the data quality control prescribed on a national level. Data is exchanged mostly using online transfer and tools with fast and adequate provision of information service. The working group meets annually. Data is exchanged according to the issues addressed in the working group meeting agenda. As most of the groundwater monitoring data is publicly available online, the additional transfer of the data is only rarely needed in recent years. The exchange of the reports is usually performed after the meeting. Data is stored in national databases. Most of the databases are accessible and open for public use.

Joint monographs and expert reports were produced in long-term cooperation between the parties of the working group. The parties are engaged in common international projects with the scope to maintain the good groundwater status of the common groundwater body. Joint reports are published every few years.

The reports and the progress of the working group are regularly reported on the regular annual sessions of the Permanent Slovenian-Austrian Commission for the Drava River.

Official minutes of the sessions of the Permanent Slovenian-Austrian Commission for the Drava River are available to the public on http://www.evode.gov.si/index.php?id=92

Source:

Lesson XX. Basin commissions are useful vehicles to progressively enlarge the types of data and information exchanged.

Case study XX. Working Group on Environmental Protection on the Chu and Talas River Basins

An agreement was signed between the Governments of the Kyrgyz Republic and Kazakhstan in 2000 on the use of water management facilities of intergovernmental status on the rivers Chu and Talas shared by these two countries. In 2006, a Commission on the Use of Water Management Facilities of Intergovernmental Status was established and in 2015 the 20th meeting of the Commission created the Working Group on Environmental Protection. The decisions of the working group are advisory in nature.

The Chu and Talas River basins are divided into the upper, middle and lower sections. In the upper and middle sections, water sampling and analysis are carried out by Kyrgyz authorities, such as Kyrgyzhydromet, the State Agency for Environmental Protection and Forestry Management, the Land Reclamation and Hydrogeological Expedition, and the Department of State Sanitary and Epidemiological Supervision of the Ministry of Health. In the lower section of the Chu River as well as the middle and lower section of the Talas River, water sampling and analysis are performed by laboratories of Kazhydromet.

Until 2019, water samples were taken by each Party separately within their own territory at different points in time. The Working Group concluded that it was essential to develop a coordinated surface water quality monitoring programme. The Commission requested OSCE support to develop and implement the programme. Since 2019, every year there have been four seasonal coordinated sampling campaigns. The sampling by Kyrgyzhydromet and Kazhydromet takes place in parallel at cross-border points at the same time (taking into account the time for water to travel to the sampling points from Kyrgyzstan to Kazakhstan). The sampling follows the same standard (GOST 31861-2012). The sampling points and indicators were agreed by Working Group members.

The created joint platform has supported the monitoring of the surface water quality in the river basins and increased cooperation between the countries. There is an understanding that the basin principle of water quality monitoring and assessment is necessary for coordinated and effective decision making taking into account regional specifications.

The Chu and Talas example demonstrates how cooperation has gradually progressed over the years from joint maintenance of several water management facilities to other areas of cooperation, including water quality monitoring and assessment. The role of the joint Commission and its secretariat has been crucial in this respect.

Source: Gulmira Satymkulova presentation in Astana 1.2.2023

Lesson XX. Develop procedures how to exchange data on planned measures

Lesson XX. Use satellite data

Lesson XX. Agree on monitoring network that provides information for all riparians: identify most indicative indicators of common concern, agree on monitoring sites for bilateral data exchange, establish common templates/rules for data exchange. Specifying the needs in information production to support transboundary

basin and aquifer systems management and the strategy for data production access and information production/dissemination allowing to match the needs

Lesson XX. Develop data production in reinforcing the traditional monitoring at transboundary level and in promoting the use of innovative monitoring technologies (Earth Observation systems, Crowd sourcing, etc.).

5. Harmonization and quality assurance

This chapter describes the lessons learned around how the harmonization of data is arranged (e.g., how the comparability of the data is secured) as well as the quality assurance and quality control (e.g., data validation).

Lesson XX. Harmonize and integrate the use of models with measurements. A combination of measurement data and models can help to provide relevant information.

Case study XX. Okavango River Basin

The Okavango River Basin is shared between Angola, Botswana and Namibia. The countries have statistical agencies which are the primary national institutions mandated with documenting, storing and distributing national data.

The OKACOM Data Sharing Procedures is the instrument and agreement for data sharing among Member States. Data sharing has been going on for since 2020 based on this agreement which also led to the establishment of the OKACOM Environmental Monitoring Framework. Each Member State finances all data collections as per its usually departmental activities. ICPs also support from time-to-time joint data collection and basin-wide monitoring which contributes greatly to data on ungauged streams

The data sharing procedures set some quality assurance principles. The OKACOM Decision Support System ensures that data will be stored in a consistent format from all Member States and at the same time provides a platform for harmonization of national databases both in data format, technology and systems used for Hydromet-gauging and data storage. The need to continue to expand this harmonization has been identified. Data is commonly exchanged as raw data files, paper/report, and provision of information service especially in the form of flood bulletin. Bi-annual for raw hydrologic data, daily for flood product services over a period of three months/active flood and ad hoc or per availability for all other.

The process is not fully developed but the common database is linked to the OKACOM DSS. This is findable with strong data interoperability and accessibility by the general public to some extent. There are joint reports, depending on the regularity of joint activities. Decision makers are informed through direct information sharing and at OKACOM statutory meetings which happens twice a year.

Information is posted on the OKACOM Website, but the DSS will have a dashboard section providing information to the public through web. Also, through community visit programs information is shared.

Source:

Case study XX. Water balance data reconciliation on Lake Fertő

Based on the agreement between the Republic of Austria and the Hungarian People's Republic on the regulation of water management issues in the border region of 9th April 1956, hydrological data are shared. The hydrological data are produced and processed by both institutes that are funded from the central budgets of the Hungarian government and Burgenland federal government. The parties provide their data to each other free of charge.

The Hungarian and Austrian water management institutes jointly process and exchange the time series of annual hydrological data. The water level, water discharge, precipitation, and evapotranspiration time series of the numerous hydrological monitoring stations on lake Fertő and its watershed are evaluated annually. Water balance data are processed by each side, and it's been evaluated during a joint meeting.

The partners send each other the hydrological and meteorological data needed for the water balance throughout the year. Accordingly, both parties can calculate the water balance using all the necessary data available for Lake Fertő catchment. The calculated water balance will be jointly evaluated and improved as necessary.

The hydrometeorological elements of the water balance (water levels, water discharges, precipitation time series, evapotranspiration data) are stored in MS Excel form, the printed form of the summarized results are an appendix of the minutes of the common Hungarian-Austrian Subcommittee. Each partner stores their data in their own database (in Hungary it's called Hydrographical database [VRA]). The processed data of the Hungarian stations are free of charge for researchers, students or any non-commercial use. The Hungarian partner is not allowed to publish or provide the Austrian data for any use.

Joint minutes are drawn up in both languages, that summarize the work done. These minutes are made annually. The decision makers are informed about this evaluation annually, which is a part of the annual meeting of the common Hungarian-Austrian Subcommittee.

Source:

Lesson XX. Establish a joint working group to discuss about the harmonization of the data.

Lesson XX. Joint sampling for harmonization

Lesson XX. Need to have common procedure and have comparable data and information at different levels

Lesson XX. Regional coordination and technical cooperation is needed to ensure that data and information be generated and available in compatible and harmonized format in accordance with agreed parameters and methodologies.

6. Data management, processing, and exchange

This chapter describes the lessons learned around how the data are stored, analyzed, and interpreted, including potentially harmonized assessment methods and modeling. Also, lessons learned on how the exchange of data is arranged and what issues come up there.

Lesson XX. Technical cooperation can be a springboard for multi-disciplinary cooperation. Cooperation at the technical level can be a way to showcase the importance of cooperation. When this is recognized at the political level, cooperation can be expanded.

Case study XX. Exchange of Data and Information in the Study of the Pretashkent Transboundary Aquifer

The Pretashkent Transboundary Aquifer is an example of a medium-sized deeply buried artesanian aquifer with negligible recent recharge. It is shared between Kazakhstan and Uzbekistan. There are two main challenges for the aquifer associated with the decrease in groundwater level due to water abstraction: 1) Depletion of groundwater storage and 2) Potential degradation of groundwater quality.

The Governance of Groundwater Resources in Transboundary Aquifers (GGRETA) project, implemented by UNESCO-IHP, aimed at strengthening regional stability, cooperation and peace through the establishment of cooperative frameworks for transboundary groundwater governance. The Pretashkent aquifer was chosen as one of three pilot aquifers and regions and contributing to stronger cooperation.

The first phase of the GGRETA Project (2013-2015) recommended building capacity for international cooperation on joint management of groundwater resources and data exchange on hydrological monitoring, creating and operating a mathematical simulation model to be used as a basis for groundwater management and developing a consolidated strategy for Kazakhstan and Uzbekistan to manage the risk of degradation of the aquifer. A mathematical simulation model of the aquifer was subsequently created as part of the project's third phase (2019-2022) along with three scenarios for future management of groundwater resources of the aquifer.

Next steps include:

1. Make the created model a permanent operating one in the two states.

2. Build capacity for international cooperation on optimal joint management of groundwater resources based on the agreed scenarios and a permanent operating model and exchange hydrogeological monitoring data.

3. Ensure on-going monitoring of the aquifer groundwater in all operating wells, regardless of their affiliation and purpose. Monitor the technical and environmental condition of water intake wells.

4. Improve national legislation to ensure mandatory groundwater monitoring in the aquifer.

5. Limit the extraction rate in wells in strict accordance with the values of exploitable resources agreed by the countries and approved by them.

6. Ensure the development of a system of accounting for the volume of aquifer groundwater abstraction and use at the national and interstate levels, and a regional water cadastre to register groundwater abstraction across the aquifer. The database of such accounting would be used as a main input for the aquifer management model.

7. Upgrade the state of groundwater monitoring system by installing modern equipment for recording the discharge rates and pressure in wells. Implement data quality control measures in accordance with the international standards. Develop groundwater quality monitoring programmes covering the entire aquifer.

8. Develop international cooperation between the two states on the aquifer groundwater quality, agree on water quality assessment standards and develop an arrangement for the exchange of this data between Kazakhstan and Uzbekistan.

Source: Valentina Rahimova presentation in Astana 1.2.2023, GGRETA - Pretashkent Transboundary Aquifer | ISARM

Lesson XX. Build a common repository of the information to be communicated. A common repository has the advantages to support data harmonisation and to arrange accessibility, among others. Clear arrangements are needed to ensure proper operation and maintenance of the repository.

Case study XX. Amazon River Basin

The Amazon River Basin is shared between Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela. A Permanent Secretariat of the Amazon Cooperation Treaty (SP-OTCA) exists with representatives of agencies and secretaries of water resources of the riparian States and is based on the Amazon Cooperation Treaty, signed by the Amazon countries in 1978. A Strategic Action Program for the Integrated Management of Water Resources in the Amazon Basin (PAE) was developed in 2017.

Data sharing is done with the budget of the SP-OTCA and resources of the "Amazon Project - regional action in the area of water resources" (SP-OTCA cooperation with the National Agency for Water and Basic Sanitation of Brazil - ANA and the Brazilian Cooperation Agency - ABC). Data include hydrometeorological monitoring of river levels and flows, water quality monitoring, and critical situations (floods and droughts). Collection of the data is done on the basis of hydrological and water quality monitoring protocols. A diagnosis on hydrological and water quality monitoring protocols in riparian countries was done and a proposal for a standardized protocol for the Amazon Basin is being developed.

The data is exchanged by online access (web service) between the information systems of the riparian countries and the Amazon Regional Observatory of the SP-OTCA. Hydrological data is exchanged every hour. The water quality data is exchanged every 7 days. The data is stored in the joint database of the Amazon Regional Observatory of the SP-OTCA. The database is accessible and open to the public on the website of the Amazon Regional Observatory. The data can be downloaded by API in Excel, JPEG and CSV format.

There are no reports yet, but there are plans to do so in the future. A Water Resources Situation Room was implemented in the SP-OTCA. From this room, drought and flood early warning bulletins and reports will be produced for decision makers and the public.

Source:

Case study XX. The Drin River Basin

The Drin River is a transboundary river basin shared by five riparian countries, i.e., Albania, the North Macedonia, Greece, Kosovo, and Montenegro. It provides water resources for drinking, energy, fishing, agriculture, biodiversity, tourism, and industry. Although the National authorities in the basin collect a lot of complex data, they have limited access to these national data, which is neither collected nor stored in a harmonized manner by all. This had been recognized as an obstacle to transboundary cooperation, so, in 2011 the Ministers from the five Riparians, agreed that one of the priority actions to address this concern is the "improvement of information exchange through the establishment of a system for regular exchange of relevant information among competent authorities of each party".

The GEF Drini Project (implemented by UNDP and executed by Global Water Partnership -Mediterranean (GWPMed) in cooperation with the Water Convention Secretariat has supported the implementation of the MoU since 2016. As a result, a number of preliminary analyses of the Drin basin's environmental situation was made and following the Expert Working Group for Monitoring and Information Exchange advice, the Drin Core Group decided to design a tool that would satisfy the need to store and share comprehensive scientific data on the Drin basin level. After two years of data collection from national institutions and careful software design, the Drin Information Management System was born. It is developed as a GIS based free online tool available in all Drin languages that allows for easy collection, exchange and presentation of data concerning the Drin basin environment, societies and economies. Designed in a user-friendly way, the IMS is an invaluable TOOL to transboundary cooperation. It is available at dringis.org and is currently maintained by the Secretariat of the DCG (GWP-Med) and administered by the representatives of the Drin Riparians.

Additionally, responding to the need of establishing transboundary monitoring, the GEF Drin project supported a pilot activity implemented in cooperation with UNESCO aiming to design and test a modern multi-purpose transboundary groundwater monitoring network in the Skadar/Shkoder – Buna/Bojana Delta transboundary alluvial aquifer (Albania & Montenegro) in line with relevant EU legislation. The results will be used to upscale related activities at the Drin Basin level.

Source:

Lesson XX. Use models for forecasting

Lesson XX. Develop the capacities to exchange comparable data and to interconnect the partner information systems (interoperability), using common language (concepts/referential dataset) and common procedures.

7. Reporting and use of data

This chapter describes the lessons learned around how the reporting is done, including the purpose of the reporting, is there a joint report and how is the reporting organized, is the information used for different (international) reporting obligations, is the data publicly available, how data reach decision-makers, etc. Different types and levels of reporting will be addressed.

Lesson XX. Disseminate information to all relevant sectors and ministries. To ensure support from sectors and ministries, it is important that they are informed on the outcomes of monitoring. The reports should provide ministers with relevant information to support informed decision-making but also reiterates the importance of monitoring each time the minister receives relevant information.

Case study XX. Cooperation on the Jordan River basin

Based on the peace treaty of 1994 between Jordan and Israel, the Jordan valley authority exchanges data on the environmental conditions and on critical situations. Harmonization of data and quality assurance is based on formal letters. Sharing of data takes place according to the need for information. Reports are submitted directly to the minister and the secretary general.

Source:

Lesson XX. Ensure the exchange of knowledge between technical specialists and decision-makers. By actively disseminating results of monitoring to decision-makers there will be a growing understanding of the situation in the basin at the policy level, which can lead to better informed decisions.

Case study XX. Aral Sea Basin

There are five Central Asian states within the Aral Sea basin: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

The Scientific-Information Center of the Interstate Commission for Water Coordination in Central Asia (SIC-ICWC) and its national branches should be financed in the part of developing and maintaining an information system at the expense of contributions to the International Fund for Saving the Aral Sea (IFAS), with the costs shared by the republics proportionally to the volume of water resources used. The activities of the central offices of the River Basin Authorities and the SIC-ICWC are funded by the Republic of Uzbekistan as a contribution to the IFAS. Other sources are also used (projects, grants, etc.). Obtaining data under contracts with hydrometeorology services on for-profit activities. Acquisition of statistical bulletins from industry-sponsored organisations.

The SIC-ICWC prepares information and analytical reviews on the state of water resources and their forecast, compares operational forecasts and actual data on the use of water resources and river water balances of the main rivers of the region to be used by national agencies and other stakeholders, among other things – on request. The reviews are based on mathematical calculations and modelling. Analytical reviews facilitate integrated assessment of the water management situation in the basins of the Amu Darya and the Syr Darya rivers and their sections.

The SIC-ICWC has created the Regional Information System on Water and Land Resources in the Aral Sea Basin (CAWater-IS) (http://cawater-info.net/data_ca) with access granted to the ICWC members and their authorised organisations.

The available online system offers a user interface with integrated databases. The IS is stored on the SIC-ICWC portal. Most of the information is open to users, 1/3 of the information (national data) is disclosed upon official requests. Analytical information is provided on a contractual basis.

The SIC-ICWC disseminates a weekly newsletter "Water Sector, Irrigation, and Ecology in Eastern Europe, the Caucasus, and Central Asia", published once a week in Russian (also posted on the website at http://cawater-info.net/news/index.htm). It contains information about key events in the region in the field of water management, land reclamation, ecology, power generation, as well as (every ten days) analytics on the water management situation in the Amu Darya and the Syr Darya river basins. The reports are publicly available in the ICWC Bulletins (http://www.icwc-aral.uz/icwc_bulletins_ru.htm). Reports within the framework of joint projects are published in open sources. All periodicals are regularly shared with the ICWC members, ministries and agencies, as well as ICWC partners within and outside Central Asia.

Source:

Lesson XX. The information as collected should serve the purpose of better management through cooperation. Monitoring information as shared will help to build a good understanding of the situation in the basin at hand. Where there is common information, agreements can be made on the management of the water in the basin, ensuring that the water is shared in an equitable way.

Case study XX. Transboundary deep groundwater body in the Lower-Bavarian-/Upper-Austrian Molasse-Basin

The transboundary deep groundwater body in the Lower-Bavarian-/Upper-Austrian Molasse-Basin is shared between Germany and Austria. For the sustainable geothermal use of the transboundary deep groundwater body in the Lower-Bavarian-/Upper-Austrian Molasse-Basin a strategy for use and protection of the deep transboundary groundwater body was jointly developed between Germany (Bavaria) and Austria. Details of the strategy are outlined in "Principles of geothermal use of deep groundwater body in the Lower-Bavarian-/Upper-Austrian Molasse-Basin" [5]. A bilateral Expert Group "Thermal Water" was established within the legal framework of the Regensburg Treaty (1987) on Water Management Cooperation in the Danube River Basin, in which the key authorities from the German federal state (Land) of Bavaria and Austria are represented. The Expert Group developed the scientific knowledgebase, a combined and balanced monitoring programme with regular data exchange and appropriated tools, notably a numerical groundwater model, to support the transboundary management of the groundwater body.

Data and information exchange is organized in regular expert group meetings. Each Party is responsible to cover its own costs. Data are exchanged regularly at least once per year in frame of expert groups meetings. If needed, data are exchanged between responsible institutions on demand (e.g. via email). The data collected is kept in national databases.

Source:

Lesson XX. Facilitate the sharing of information between stakeholders.

Lesson XX. Clearly define the audiences for dissemination of the information.

Lesson XX. Launch an initial communication plan at the beginning of the project, and update, adjust and revise it progressively.

Lesson XX. Tailor messages to your audience, based on its characteristics and needs.

Lesson XX. Select appropriate instruments to communicate the information.

Lesson XX. Establish mechanisms for regularly reviewing the monitoring system in order to ensure relevant information.

Lesson XX. Let the information tell a story

Lesson XX. Basis for resolution of disputes

8. Impacts and benefits

This chapter describes the impacts or benefits from data and information exchange as reported.

Inventory from the case studies

Early warning:

- enable forecasts and improve the quality of forecasts – floods, low water (navigation), pollution
- authorities and the public can prepare themselves, protect goods and persons, evacuate if necessary and in the end, save lives (social impact) and reduce the damages (economic impact)
- reducing loss of lives and livelihoods
- preparations for the agricultural seasons
- improved long term planning

[5] https://www.land-oberoesterreich.gv.at/files/publikationen/gtw_grundsatzpapier2012.pdf

Water quality:

- impact for the environment as there should be more water available for ecosystems in low water situations
- information and data could reverse current and future degradation trends through improving scientific understanding of the shared water

Awareness:

- help the public to be aware of the situation in every part of the international basin and to understand the gravity of the situation
- having a common language between both countries
- use of results by a broader public, reaching academia, users, the press, among others, with concrete results
- better understand water resources
- consolidate entities and international support and increasing public awareness and stakeholder participation

Policy and management:

- improve programmes of measures
- management decisions improve greatly on how to safeguard the environment and which socioeconomic activities to promote and demonstrate how responsible development ensures environmental sustainability and at the same time enhance social justice and economic development especially among riparian communities
- positive impacts at the environmental and diplomatic levels
- advance in a coordinated and integrated management of water resources
- strengthening of the institutional coordinating role of the RBO
- added value for decision-making to the countries and the institutions linked to the management and use of water in the basin
- join efforts and synergies with common objectives
- better evaluation of data gaps in the basin
- Knowledge is considered as an integration lever, a means towards a more global strategy
- Improved hydraulic infrastructure design
- Data exchange contributes to decision-making and transparency of decisions

Coordination:

- getting to know each other better
- strengthen territorial coordination
- Establishing personal relationships, building team spirit and international exposure of the region cooperation
- Well maintained transboundary water cooperation among the parties, well-kept trust among members of the of River Commission and its expert groups, ensured professional growth of experts, based on regular exchange of experiences, knowledge, methods, approaches and practices, proof-based bilateral coordination of transboundary protection of groundwater resources, access to the data beyond national borders etc.
- importance of such platform to discuss the transboundary issues caused by climate and other changes
- enhanced co-creation of knowledge can provide a greater understanding of the challenges to help make better decisions for the development of transboundary river basins

Lesson XX. Added value from developing transboundary water cooperation

Case study XX. Developing Transboundary Water Quality Monitoring of the Teno River between Finland and Norway

Finland and Norway signed the Agreement concerning the Finnish-Norwegian Transboundary Water Commission in 1980, with the agreement entering into force in 1981. The purpose of the agreement is to

"preserve the unique natural conditions of the transboundary water bodies and their surroundings, and to secure the interests of both parties to the agreement, and especially the residents of the border region, in matters concerning the use of transboundary water bodies".

To implement the agreement, the Parties appointed a joint transboundary water commission, which acts as a joint cooperation and liaison body of the contracting parties in matters concerning transboundary water bodies. According to the agreement, the government of each Party appoints three members and one or more deputy members to the commission, with experience (1 member) required in state water authority and (1 member) conditions of the border region. In practice the third member has been appointed as a representative of the local indigenous population (Sámi).

The agreement defines the water areas to which the agreement applies as well as the matters on which the commission can make proposals, statements and initiatives. According to the agreement, the role of the commission is to provide advice and promote cooperation. It does not have actual decision-making power regarding transboundary waters.

In the second meeting of the commission, it was decided that Finnish and Norwegian regional authorities would appoint an expert working group to prepare a joint water quality monitoring and reporting program for the Teno River, which is an important spawning river for Atlantic salmon shared by the two countries. The program was approved in 1987 with physical-chemical monitoring of water quality agreed to start in 1988 and biological monitoring in 1989. The first loading and water quality report was completed in 1990, resulting in the identification of a significant impact from domestic wastewater from the Norwegian side. The Norwegian government complied with the Commission's recommendation by constructing water treatment plans.

The program was implemented jointly by the two countries, with the Norwegian side in charge of collecting water samples, and the Finnish side analyzing them. The processing and reporting of the results was carried out in Norway. In this way, the costs from the monitoring program were distributed practically equally. This method of monitoring, based on mutual trust, was unique in transboundary water cooperation at the time. The methodology strengthened cooperation between participating authorities reflecting positively in the work of the Commission. After Finland joining the European Union, the monitoring of Teno River was developed to meet the requirements of the Water Framework Directive and the Flood Directive.

Source: Kari Kinnunen, 26.2.2023

9. Main difficulties and challenges

This chapter describes the main issues and challenges that were reported as well as the conclusions that can be drawn. Possibly, the issues and challenges will be included in the form of lessons learned in the different chapters, making this chapter obsolete.

Inventory from the case studies

- Lack of legal frameworks in three river basins
- Mistrust with neighboring countries
- Different level of development
- Insufficient number of hydrological and meteorological stations
- Knowledge gap between riparians
- Political instability in the region
- During floods stations were flooded and destroyed
- when different services of the same delegation are responsible for different data - different systems used by national and local authorities

- find agreement to analyze the parameters at the same frequency
- departmental financing for data collection continues to be more and more inadequate
- harmonization of shared information
- The main difficulty is funding
- Limited number of human resources
- Limitations in the training of human resources
- Lack of specific agreements to share information
- Lack of budget to carry out face-to-face meetings and training
- System compatibility and funds for system development
- production of consistent data files in the countries, and the need for a formal structure to exchange data
- Some countries do not have an open data policy, making it difficult to exchange data and information
- awareness/training of the national partners on the procedures of shared management and their adhesion to the processes
- The quality of data is often not good enough
- Different in the riparian countries
- Difficulty of obtaining information from national agencies
- Fragmentation of data from different agencies even within one country
- mistrust between and among the riparian countries because of political rivalries and conflicts
- Data and information is considered sensitive

Opportunities:

- Presence of political will
- Water as an element of regional cooperation and integration
- Ongoing negotiations with downstream riparians
- Transboundary Waters Policy
- Data and Information Policy Exchange Policy

Lesson XX:

Case study XX. Main challenges for strengthening data exchange at regional level in Central Asia

The International Water Assessment Centre (IWAC) organized a regional workshop on monitoring, assessment and information sharing in transboundary basins in Central Asia in February 2023. The workshop aimed at facilitating the exchange of experience in the field of monitoring water resources and improving cooperation between five countries in the region (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) on the protection and use of water resources.

Workshop participants noted the positive trend in data exchange in the region and identified many good examples of cooperation on monitoring and data exchange, including the Chu-Talas Water Management Commission (Kazakhstan-Kyrgyzstan), water quality monitoring in the Syr-Darya River basin (Kazakhstan-Uzbekistan), hydrological data exchange between national hydrometeorological authorities, and cooperation, assessment and modelling in the Pretashkent transboundary aquifer (Kazakhstan-Uzbekistan).

However, participants noted that several challenges for monitoring and assessment of water resources in the region do not receive sufficient attention. The workshop highlighted the need for joint efforts to harmonize data collection, strengthen monitoring and data exchange on water quality, develop early warning systems on water pollution at transboundary waters and improve the collection and sharing of data on transboundary aquifers. Specific challenges noted by participants were insufficient funding and lack of proper equipment limiting monitoring and data exchange, need for more interactions on hydrological forecasting and development, lack of access to information and data on water resources,

limited focus on consolidating efforts to combat climate change effects, lack of agreements on groundwater and the need for joint bodies to coordinate monitoring and assessment.

Participants emphasized the need for a phased approach to developing interactions between the countries on data exchange in transboundary basins based on existing national monitoring systems, harmonization of methodology and standards for data collection, development of a regional observation network and the development of institutional mechanisms for regular data exchange in transboundary basins. The workshop outcomes highlighted the importance of developing bilateral and regional agreements regarding cooperation on monitoring and assessment of water resources including specific mechanisms for joint monitoring and regular data exchange.

Source: Outcomes from the Regional Workshop on Monitoring, Assessment and Information Sharing in Transboundary Basins in Central Asia, Feb 1-2, 2023

On groundwater data exchange vs. groundwater assessment

Groundwater systems are 3-dimensional, often complex environments, with limited observation points (springs, wells), whose assessment usually requires expensive and long-term efforts.

In the majority of groundwater systems, the resource must first be assessed and understood sufficiently, e.g., identify the location and the volume of groundwater, the flow direction and rates (which may vary at depth and over time).

When an aquifer has been reasonably assessed, the interpretation of groundwater monitoring data still requires continuous efforts, again due to the complexity of groundwater systems.

The exchange of data is useless if not followed by data interpretation.

Relevant experts, like hydrogeologists in an aquifer, should be engaged on a permanent basis in the structures in charge of transboundary cooperation (e.g., RBOs, joint bodies).

On the conditions for groundwater data exchange and assessment

Technically speaking, the sharing of data is not demanding. It can be as simple as forwarding data files per email or storing them on a shared ftp server. We remark that data sharing is even more straightforward when riparian states have their groundwater data public, like Canada and USA.

If it isn't for the protocols and for the technical requirements, what makes groundwater data exchange efficient or not? In the first place, it is necessary that the country have consistent groundwater datasets to share. Unfortunately, many countries have no strategy or capacity to consistently collect groundwater data. Joint groundwater assessment also requires capacity, starting with hydrogeologists who can dedicate themselves to the assessment of transboundary groundwater. In this context, it is no surprise the few successful cases of transboundary groundwater data sharing and assessment that we are aware of are restricted to high-income regions, mostly in Europe and North America.