The International Centre for Water Resources and Global Change (ICWRGC), the German-Kazakh University (DKU) and UNESCO held 3 consecutive events at the UNESCO Regional Office in Almaty from October 16-20, 2023. Supported by international experts from WMO, GWP, global glacier and water data centres, regional scientists (e.g. IWMI, CAREC) and competent governmental hydro-met experts from the four Central Asian countries attended the events to exchange views on the current situation and common interests for further cooperation. The participants were invited according to their expertise and competences in line with the different topics of each event. The very lively discussions and work were supported by simultaneous translation in English and Russian language.

The three events were scientifically connected to jointly contribute to a better understanding of the climate change impact in terms of disaster risk reduction and a sustainable future water management of the whole region and in the individual countries. Furthermore, these events contribute to the implementation of the 9th Phase of UNESCO´s Intergovernmental Hydrological Programme (IHP-IX, 2022-2029) "Science for a Water Secure World in a Changing Environment", WMO´s Hydrological Action Plan 2030, UNEP´s GEMS/Water programme and national and international water monitoring initiatives and databases.

The events were embedded in the German Green Central Asia (GCA, https://www.greencentralasia.org/en) initiative and the activities of their German experts from the GIZ Office in Tashkent, Uzbekistan, scientists from the Martin-Luther University Halle-Wittenberg and GFZ German Research Centre for Geoscience in Potsdam.

Glacier seminar

The week started with the seminar "**Climate Change and Glaciers – Significance and Impact on Water Resources in Central Asia – Tien Shan, Pamir and Hindu Kush Mountains".** This seminar set the scene for the following workshops on wider boundary conditions. Climate change poses growing security concerns in Central Asia and Afghanistan, where drastic ecological changes endanger water, energy and food security, leading to pronounced political instabilities and changing socio-hydrological interactions. Thus, consequently, the stability of the region as a whole is at stake.

Four presentations described the current knowledge and highlighted the precarious future of the world's frozen places including the Central Asia region and the Third Pole. A new study projects that the world would lose half its mountain glaciers in case of a temperature rise of 1.5 C° by 2100, which is already causing high melt water flows and a higher risk of landslides in Central Asia. The discussions also contributed to the preparation for the UN International Year of Glacier Preservation -2025. These presentations were followed by group discussions on gaps and solutions for science, policy and practice and resulted in the following agreed key messages:

Science:

- There is a general need for increased monitoring of glaciers, changes in cryosphere and permafrost
- The methodologies for mass balance calculations need to be improved

Practice:

- Changing glaciers threaten water availability but also increase disaster risk
- Transparency is needed in the fields of water use and water availability
- There is a need for an automated monitoring of water use

Policy:

- IWRM and NEXUS approaches should be implemented
- More transparency and dialogue between countries
- A management of Glacial Lake Outburst Floods (GLOF) needs to be introduced
- As climate change impacts are already palpable, countries and regions have to invest in adaptation strategies and not only invest and wait for long-term data acquisition
- It is difficult to receive funding for long-term monitoring

The seminar's outcome will be used for the following ongoing initiatives

- the GEF-UNDP-UNESCO on Cryosphere to strengthen the resilience of Central Asian countries by enabling regional cooperation for assessing glacio-nival systems to develop integrated methods for sustainable development and adaptation to climate change,
- UNESCO´s and WMO´s preparations on the International Year of Glaciers' Preservation, 2025,
- the German engagement for Green Central Asia,
- Contribution to the Implementation of UNESCO's IHP-IX (2022-2029) Science for a Water Secure World in a Changing Environment
- input of ICWRGC to the International Conference on Mountain Hydrology and Cryosphere, IAHS Nepal chapter, November 9-11, 2023 in Kathmandu, Nepal (https://www.iahs-nepal.org/icmhc-2023).

The seminar was followed by two workshops prepared by ICWRGC, where a limited number of competent country experts worked together with selected international experts. Each workshop had around 20 participants.

Hydro-met data workshop

The first **workshop from October 17-18 focused on Water Data**. It was the 3rd Water data workshop of ICWRGC whereas the first two workshops in 2020 and 2021 involved countries in Western Asia. Key individuals from the fields of water planning and policy support (e.g. national hydrological and meteorological services, water-related ministries) from Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan came together and exchanged information about hydro-meteorological data available in their countries and shared their views on data sharing policies. In addition, WMO described its range of engagement and support granted to its Member States to improve the state and situation of hydrological observations and data sharing, including the Unified Data Policy (WMO Res. 1, 2021) and the newly published WMO State of Global Water Resources report 2022. The leading global data centres for precipitation (GPCC), river discharge (GRDC), soil moisture (ISMN) and water quality (GWDC), as well as the Global Terrestrial Network – Hydrology (GTN-H, https://www.gtn-h.info/), supported the dialogue with the delegates from Central Asia by means of presentations and discussions. All participants showed great interest in discussing their current monitoring situation of

essential climate and water variables, in light of the enormous challenges due to climate and anthropogenic changes in their countries. Apart from discussing and exchanging experiences, the participants completed a survey on national water information available in their countries. These surveys will be shared among the participating countries and the international experts involved.

Key messages from this workshop are:

- The country representatives are very interested in increasing cooperation and aligning their data monitoring and management to international standards and systems (e.g. FAIR- data online as service for the public and for further use.)
- The activities in terms of in-situ observation networks and data management decayed after the independence of the Central Asian countries from the former Soviet Union in the early 1990s. Joint activities with a common understanding of transboundary river systems and aquifers is desired.
- The workshop was very useful to strengthen this dialogue and shall be continued with the analysis of the information given in the templates.
- Further competent country experts will be informed and connected.
- There is a major need to improve water monitoring by means of concepts, suitable measuring technologies, data processing and management tailor-made to the essential climate and water variables and to the landscape (e.g. high mountains).

OUTLAST stakeholder workshop

The 3rd event was **held on October 19-20 and completed this fruitful working week with the 2nd regional stakeholder dialogue for the co-design process to establish and implement the first worldwide, multi-sectoral, and operational drought forecasting system** for quantifying drought hazard in water supply, riverine and non-agricultural land ecosystems, rainfed and irrigated agriculture. It is intended to provide a model-based product with scientific support from a network of German research institutions to ensure that the results are both scientifically plausible and informative in a practical perspective. The project partners are Karlsruhe Institute of Technology – responsible for meteorology, Goethe University Frankfurt am Main – responsible for hydrology and University of Göttingen – for agriculture. This new tool is the objective of the German research project OUTLAST (2022-2025, https://outlast-project.net/). The workshop is the first attempt to bring stakeholders from Central Asian countries (including national hydro-met services) on board to develop operational drought indicators on a global scale in OUTLAST, which will be disseminated through the WMO HydroSOS portal and in the long run will be very helpful for users from all over the world. The feedback of the invited participants comprising users, stakeholders, and policymakers from multiple sectors is necessary to ensure the tool's future success. The preparations were based on experience made during the 1st stakeholder dialogue in Nairobi, Kenya, Africa, on September 4-5 2023 with country experts from Burundi, Kenya, Rwanda, Tanzania, and Uganda around Lake Victoria.

The participants came from various government agencies, research institutions, national meteorological and hydrological services from four countries: Uzbekistan, Kazakhstan, Tajikistan and Kyrgyzstan, as well as from IWMI, Martin-Luther-Universität Halle-Wittenberg and the German-Kazakh-University in Almaty. They worked together with guiding presentations and templates to figure out which drought indicators are preferred in Central Asia and should be used for the tool. The stakeholders from the four Central Asian countries provided opinions based on their own needs and

requirements for drought management to define a set of drought hazard indicators considering three aspects: meteorology, hydrology and agriculture.

Key messages from this workshop are

- With the main focus on drought, extreme hydrological events, OUTLAST could bring opportunities to enhance the provision of drought risk information in time to inform decision-makers. This would lead to more stability in multiple sectors in the region and contribute to mitigate the impact of climate change with its seasonal forecasting product, which is the main focus of the German initiative Green Central Asia.
- The participants stated that the drought indicators presented and the discussion on a meaningful selection for the drought forecasting tool has already been useful for their own operational work. Furthermore, they would be interested in testing the pilot project in the region.
- The National hydrometeorological service of Kazakhstan (KAZHYDROMET) presented their work to set up a full national drought monitoring system. They are interested in adding a drought forecasting system.
- The OUTLAST workshop showed that working with national services, research institutions and potential end users in the region on a specific instrument, serves as a bridge for future potential cooperation and collaboration with stakeholders from the participating countries.

Outlook

All organizers and participants are interested and motivated to continue and develop specific common activities in the Central Asian countries. As a first step it was agreed to provide all participants with the digital material of all 3 events. Therefore, DKU and ICWRGC will supply a protected online platform under the umbrella of the Green Central Asia initiative, where further experts can be invited. Furthermore, the platform should provide opportunities for cooperation with the UNESCO IHP related projects in Central Asia. This platform shall be used to share documents for further common activities. It is intended to hold a 4th climate and water data workshop in the second half of the next year in the region.