



GEWEX START AUCA Workshop on Central Asia

*An Exploration of Climate Science in Central Asia – Moving
Towards Frontiers of Knowledge and Action*

4-6 October 2021 | Online

Summary

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Introduction

A three-day virtual workshop on climate science in Central Asia was conducted on 4-6 October 2021. This workshop was carried out in partnership between the Global Energy and Water EXchanges (GEWEX) project, a core program of the World Climate Research Programme (WCRP), the SysTEM for Analysis, Research and Training (START), and the American University of Central Asia (AUCA) in Bishkek. This workshop was in part based on the results from an online survey on climate science needs and priorities in Central Asia that the three partner organizations conducted earlier in 2021 and that was initiated with assistance from AUCA.

The objectives of the virtual workshop were to collaboratively identify:

- key priorities for research and capacity development related to linking climate science into hydrologic research and application, glacier retreat, agriculture, land-use, land-cover change, and other critical challenges
- initial ideas for identifying and mobilizing resources that can build towards a GEWEX Regional Hydroclimate Project (RHP), and that serve to inform the emerging WCRP Regional Information for Society (RIFS) core project, and
- regionally based experts and networks that are committed to work with the partners to advance this effort.

The workshop was organized over three days in three sessions, each lasting about 3 hours and each with a different theme:

Day 1: State of Knowledge

Day 2: Approaches for Hydrologic Modeling - Demonstration

Day 3: Capacity Development Needs and Priorities

Each day featured invited speakers to provide a stimulating discussion-oriented talk followed by plenary and small group discussions on key topics.

Key recommendations that emerged from the workshop are:

1. More regional collaboration on water and climate is needed including bridging the policy-science gap
2. Inclusivity (culturally and across stakeholders) needs more attention
3. There is a need for more complete and better-quality data (incl. observations) that goes beyond just open data (resources) sharing
4. Capacity development is needed at all levels and long term, and should include strategies for adaptation and mitigation, from research to applications/implementation
5. Global and regional hydrologic projects should be coordinated and linked to the relevant communities (incl. indigenous knowledge).
6. Strong need to prevent brain drain and attract and retain young talent

Day 1: State of Knowledge

Introduction of the Partner Organizations

Peter van Oevelen introduced the Global Energy and Water EXchanges (GEWEX) project, a core program of the World Climate Research Programme (WCRP) that facilitates, enables, and coordinates international climate and related research activities with an emphasis on land–atmosphere and other processes and interactions.

Zheenbek Kulenbekov spoke about the American University of Central Asia (AUCA) and its studies of the water resources situation in Central Asia. This includes researching the development of river systems, water reservoirs, ecosystems, and risks as well as the impact of climate change on water resources in Central Asian countries and Afghanistan. AUCA also gathers information on the genesis of river basins, the physical and chemical properties of water in rivers, and the hydrological regimes of the rivers of Central Asia and Afghanistan.

Jon Padgham presented on the SysTem for Analysis, Research and Training (START), which promotes science capacity development that advances knowledge and action on critical sustainability challenges. START's work targets early- and mid-career researchers and professionals who work at the interface of science and action in Africa and Asia.

Key Messages: Invited Speakers

Tomas Saks: State of Cryosphere in Central Asia

- Glacier observation data should be freely accessible and provided via the corresponding data centers according to international standards and strategies.
- High-quality cryosphere data is an indispensable prerequisite to any sound water- and hazard-related studies in high mountains.
- Regional cooperation on water resource management and disaster risk management and awareness has to be increased and should be based on national needs and priorities.
- Gains in education and capacity building can be achieved by introducing up-to-date student courses at BSc and MSc levels through summer schools and by specialized field training.

Kakhramon Djumobaev: Application of the Water-Energy-Food (WEF) Nexus Concept to Transboundary Rivers of Central Asia

- Current government policies on energy subsidies in pump-irrigated areas do not support water and energy savings. If subsidies are eliminated, agricultural productivity will grow, agricultural water use will decrease, and energy waste will decrease, leading to reduced CO₂ emissions.
- There is a need to introduce regional platforms to discuss WEF nexus related issues.

Natalia Chemayeva: Water Policy in Central Asia and Climate Change

- The inability to bridge policy and science is a consistent challenge.
- Developing adaptive water governance mechanisms in situ is critical and this can reduce global knowledge gaps.

- Adapting a resilience assessment framework for agricultural systems is necessary to address climate risks to food production.
- Proper transboundary planning requires climate and water strategies and adoption of a WEF nexus approach at the regional level.
- Successful long-term disaster risk reduction should be built on well-designed climate adaptation strategies.

Kanat Sultanaliev: Climate Change and Agriculture in Central Asia

- Glacier observation data should be freely and easily accessible.
- The introduction of new varieties of crops, new breeds of livestock, and new agronomic techniques are needed to address increasing climate risks.
- Agriculture needs improved water use efficiency, decreased water loss, and upgraded irrigation systems.
- Farmers need access to training to adapt to increasingly volatile weather conditions and improve the sustainability of pasture grazing.
- Insurance schemes are needed for the crops and livestock of smallholders and family farms.

Breakout Room Discussions – Day 1

In these discussions, we asked our participants to address the three following questions:

1. What do you view as the top two to three priorities for research to address critical knowledge gaps, and why?
2. What are key opportunities and impediments for carrying out that research?
3. Given current and emerging knowledge, what adaptation responses are the most pressing?

Group 1

- Water-related data gaps are a critical issue in the region. For example, there is an insufficient amount of information and resources at the moment to produce good precipitation projections.
- Permafrost data gaps are also significant. We need a better foundation for the current status, good projections for the future, and new technologies in snow monitoring.
- The connections between water use, energy use, and carbon emissions need to be better described.
- We need to use the data in practice and make it all useful. There is a demand for high levels of quality, for completed climate measurements, and for Earth observation (EO) imagery and data. Collaborations should be established with people involved in modeling in the fields. High quality climate data, satellite imagery, etc. need to be easy to use, and require collaborations with the modelers so they do get used. Broad-based collaborations are required. Funding is necessary to carry this out.
- Governments should not be able to profit from their data but this is a difficult internal issue.

Group 2

- Remote sensing training is critically important for assessing and addressing land-use and land-cover change in Central Asia. Arid areas need more attention and should be balanced with studies in high mountain regions.
- Improved communication and more common understanding between scientists and policy-makers is needed. Policymakers typically have shorter-term decisions to make. Scientists often have very long-term horizons for their work. Both groups need to understand the needs of the other, and this can improve current decisions and influence the directions of research. Both groups need to be more adaptive.
- The transparency of decision-making should be clearer.
- Land-atmosphere processes data and local research capacity are limited.
- Water resource models need to provide guidance for management.
- Mountain communities may lack the ability to manage their problems. Mountain areas are very difficult, as the available data and information is quite limited.
- Global and regional hydrologic projects should be coordinated and linked to the relevant communities.
- For Central Asia, it is important to keep in mind the changes that have happened since the Soviet period. New scientific approaches are needed that move beyond the Soviet scientist mindset. And opportunities are needed in Central Asia to bring in young, talented people.

Group 3

- The scientific community and governmental organizations need to work hand in hand. Also, knowledge of Russian or Kyrgyz is important for discussions with Kyrgyz policy makers.
- Young scientists and new equipment with new techniques are needed, and
- Government secrecy should be reduced, especially with respect to policies on water distribution.
- Economic resources are limited but still need to be maintained.
- Current agricultural traditions have to shift towards using more advanced equipment.
- A long-term investment strategy that can be sustained for climate adaptation needs to be developed.

Day 2: Approaches for Hydrologic Modeling

Key Messages: Invited Speakers

Mikhail Bolgov: Hydrologic Modeling in Central Asia

The presenter provided a comprehensive overview of hydrological modeling and recommended the following priorities for research to address critical knowledge gaps:

- Development and adaptation to local conditions of runoff models that can also consider glaciation processes
- Development and optimization of a monitoring observation network and open data
- Open databases on water consumption
- Development of long-term river runoff forecasting methods

In addition, the presenter provided the following points as critical for adaptation responses, given current and emerging knowledge:

- Creation of a joint water management system for Amu-Daria and Cyr-Daria
- Creation of a joint scientific center on the problem of water resources research, forecasting, and management
- Attraction of attention and international funds for solving water problems in Central Asia

Justin Sheffield: Hydrological Modeling Demonstration

After the overview presentation by Mikhail Bolgov, a short demonstration was given of a pilot modeling and data system developed by the Princeton Climate Institute (PCI) / University of Southampton that represents the hydrological variability across the Syr Darya basin historically in near real-time, and for short-term forecasts. Such an approach has potential to support water resources assessment and management in the region, filling in gaps in instrumental networks and providing predictive capabilities for hazard early warning and water resources/agricultural decision making. The system is based on a modeling framework that simulates hydrological variability driven by merged satellite, model, and gauge precipitation data. Hydrological monitoring is updated 1-2 days behind real-time. Forecasting is done out to 7-days to provide early warning of flood conditions and other meteorological extremes. A screenshot of the system is given in fig 1. which shows the hydrological conditions in the basin in terms of soil moisture anomalies.

There was a lengthy discussion on the approach and utility of the system. The approach was compared to other systems including the global GLOFAS system, which is focused on floods, and the advantages of a tailored regional system were highlighted. Important processes for the region were discussed, such as water resources infrastructure (e.g. dams, irrigation) and glaciers, and how they could be represented in the system. A range of technical aspects were discussed including the source of the precipitation data and alternatives, the consideration of uncertainties in the forecasts (and the use of alternative models), the accuracy of the system and the calibration/validation strategy. The feasibility of extending the system to other basins was also discussed.

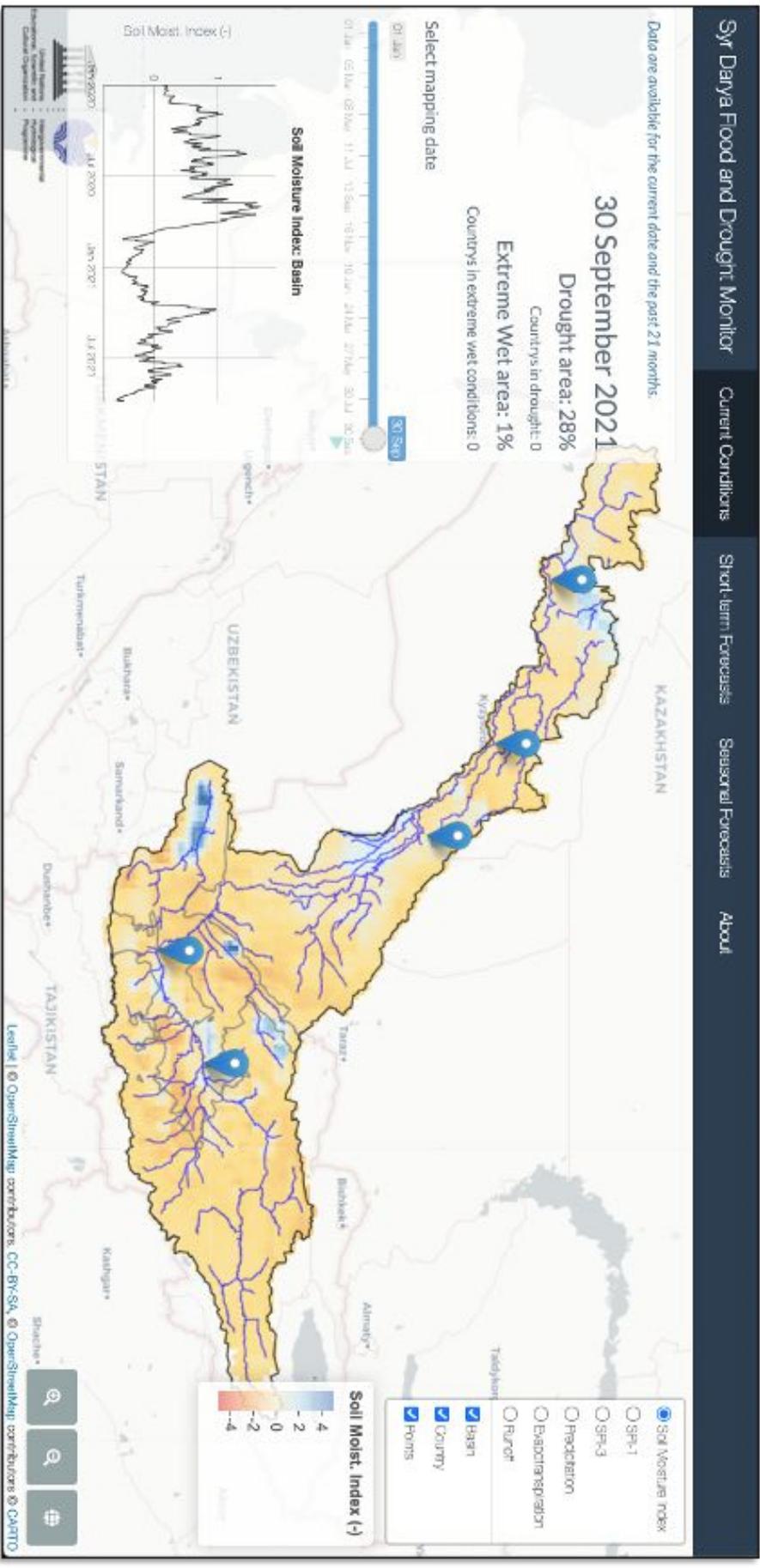


Fig. 1. Screenshot of the modeling and data system developed by the Princeton Climate Institute (PCI) / University of Southampton that represents the hydrological variability across the Syr Darya basin.

Day 3: Capacity Development Needs and Priorities

Chris Lennard: Lessons Learned from the Coordinated Regional Climate Downscaling Experiment (CORDEX) Africa

Chris Lennard provided perspectives and recommendations from CORDEX Africa that have applicability to climate capacity development in Central Asia. He emphasized the importance of building trust and shared purpose that can support long-lasting relationships across disciplines, areas of expertise, and between science and decision making that included the following observations:

- It is important to continually assess assumptions about what is known regarding scientific capacity, cross sectoral collaboration, and the knowledge base.
- Stakeholder needs and priorities should be considered early on. This requires early engagement with a representative spectrum of regional stakeholders.
- Design the questions that the analysis intends to answer in very specific terms and articulate the value that the questions achieve and for whom it is achieved so that questions have greater potential for societal relevance.
- Articulate questions with the appropriate time and space scales that can address decision-making needs.
- Design the process with long-term continuity in mind, which will include identifying potential funding sources to ensure long-term engagement.
- With respect to observed data, climate and application data is difficult to get.

Bota Sharipova: Climate Change and Capacities to Face It: State of Education and Research in Central Asia

Bota Sharipova explored the challenges of higher education and capacity development in Central Asia in the water and climate sector. Her observations included:

- There is no low hanging fruit—i.e., no quick fixes!
- Short-term capacity building is not addressing the underlying challenge of poorly resourced educational systems.
- Locally-based teachers/scientists generally do not have the resources and skills to achieve a significant improvement in educational quality. Outside expertise is also needed. Given the capacities of current teachers and scientists, it hardly seems possible to build a new generation that understands the importance of and has the skills to implement interdisciplinarity or to enable those who can become disruptors.
- Working with leading external institutions does not benefit the vast majority: focusing only on a one or few organizations does not enable overall/widespread progress.
- The shift towards interdisciplinary approaches in Natural Resources Management (NRM) faces opposition from previously (and currently) dominating technocrats, inhibiting progress.

Breakout Rooms Discussions – Day 3

The overarching questions that the breakout rooms focused on were:

1. Where is action for capacity development most needed in the region?
2. What approaches can be undertaken to advance capacity development?

Among the key challenges identified by the groups were:

- There is a tendency towards short-term credentialed training that offers limited potential for lasting skill development. The training is often not deep enough or frequent enough for environmental management capacity to be developed and sustained. Too often, training is top down and supply driven without understanding or consideration of local contexts (possibilities and limitations) in which newly acquired skills can be applied.
- There are significant institutional challenges in developing the next generation of scientists, including:
 - ♦ There are very few PhDs; Masters and bachelor-level education is more prevalent.
 - ♦ Stagnant educational systems that lack up-to-date and relevant curricula. New knowledge needs to be institutionalized in education; the problem cannot be addressed through short-term courses.
 - ♦ Graduate education should promote communication skills and collaboration across disciplines.
 - ♦ Loss of college-level technical training since the post-Soviet period hinders the ability to apply new technologies to critical areas such as water resource assessment and management.
- Sustained capacity development will require looking outside the region, by linking universities across Central Asia with universities in the US and other regions where capacities are stronger. Suggestions for doing so included: having embassies connect local universities with US institutions that can involve graduate students, long-term internships, social learning, program degrees that are designed to avoid brain-drain.
- Look to the [CORDEX Africa](#) model as an approach that could be useful in Central Asia because it integrates across disciplines, is regionally driven in how it is tailored to regional needs, and places an emphasis on building trust, credibility, and shared purpose across scientists and the decision makers they engage.

Front page images courtesy of [Daoud Alahma](#) “The mighty Tian Shan Range” (left) and inset map source: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC

Agenda

Monday October 4, 2021 – *State of Knowledge* –

- 12:00 – 12:10 [Welcome and Introduction](#) – Peter van Oevelen (GEWEX)
- 12:10 – 12:25 [Introduction to the Water Resources Situation in Central Asia](#) – Zheenbek Kulenbekov (AUCA)
- 12:25 – 12:40 [State of Cryosphere in Central Asia](#) – Tomas Saks (U. of Fribourg)
- 12:40 – 12:55 [Application of the Water-Energy-Food \(WEF\) Nexus Concept to Transboundary Rivers of Central Asia](#) – Kakhramon Djumobaev (IWMI)
- 12:55 – 13:10 [Water Policy in Central Asia and Climate Change](#) – Natalia Chemayeva (IFAS)
- 13:10 – 13:25 [Climate Change and Agriculture in Central Asia](#) – Kanat Sultanaliev (AUCA)
- 13:25 – 13:35 Break
- 13:35 – 14:50 Discussion in three breakout groups
- 14:50 – 15:00 Wrap up and Introduction to Day 2 – Jon Padgham (START)

Tuesday October 5, 2021 – *Approaches for Hydrologic Modeling* –

- 12:00 – 12:10 [Welcome, Summary Day 1 and Key Messages](#) – Zheenbek Kulenbekov (AUCA)
- 12:10 – 12:25 [Hydrologic Modeling in Central Asia](#) – Mikhail Bolgov (IWP, Russian Academy of Science)
- 12:25 – 14:50 Lecture and Training in the Demonstration Version of the Syr Darya Flood and Drought Monitor and Forecasting System (SYR-FDM) – Justin Sheffield (PCI/University of Southampton)
- [Introduction](#)
 - [Overview and Use of the Syr Darya Flood and Drought Monitor \(SYR-FDM\)](#)
 - [Exercise and Practical Guide to Using SYR-FDM Web-Interface](#)
- 14:50 – 15:00 Wrap up and Introduction to Day 3 – Michael Brody (GMU)

Wednesday October 6, 2021 – *Capacity Development Needs and Priorities* –

- 12:00 – 12:10 Welcome, Summary Day 2 and Key Messages – Jon Padgham (START)
- 12:10 – 12:25 [Lessons Learned from the Coordinated Regional Climate Downscaling Experiment \(CORDEX\) Africa](#) – Chris Lennard (CSAG-UCT)
- 12:25 – 12:40 [Climate Change and Capacities to Face It: State of Education and Research in Central Asia](#) – Bota Sharipova (IHE-Delft)
- 12:40 – 12:50 Break
- 12:50 – 13:40 Discussion in three breakout groups
- 13:40 – 14:00 Next Steps and Wrap Up – Michael Brody (GMU), Zheenbek Kulenbedov (AUCA), Peter van Oevelen (GEWEX), Jon Padgham (START)