The Global Energy & Water Exchanges Project

Proposed Central Asia Regional Hydroclimate Project
Workshop on Climate Change: Better Data, Modeling & Planning for Climate Adaptation in Central Asia

Summary of the 3rd Workshop on Central Asia

April 29–May 1, 2024
Osh State University
Osh, Kyrgyz Republic

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Abstract

This report summarizes the third workshop on the proposed Central Asia Regional Hydroclimate Project. This series of workshops seeks to identify challenges posed by climate change in Central Asia and possible regional responses. Discussions centered on identifying already-existing data that is needed, forming new observational networks, proposing climate models with better relevance to Central Asia, and labeling challenges specific to regional research. A possible outcome of these meetings is to form a Global Energy and Water Exchanges (GEWEX) project Regional Hydroclimate Project (RHP) or other program for the Central Asian region.

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Introduction

The third workshop on the proposed Central Asia Regional Hydroclimate Project was held at Osh State University in Osh, Kyrgyz Republic from 29 April–1 May 2024. There were about 55 participants total, with 40 attending in person and another 15 online, hailing from Kyrgyzstan, Uzbekistan, Kazakhstan, Germany, China, Russia, the United Kingdom, Tajikistan, and the United States.

The organizing committee consisted of Ruslan Arapbaev, Vice Rector of Osh State University; Michael Brody, International Agriculture University, Tashkent, and George Mason University, Fairfax, Virginia; Sagynbek Orunbaev, American University of Central Asia, Bishkek; Maksim Kulikov, University of Central Asia, Bishkek; Ainura Saparbaeva, Osh State University; and Peter van Oevelen, International Global Energy and Water Exchanges (GEWEX) Project Office, George Mason University.

Participants came from various universities and institutes, including the host, Osh State University. Also represented from Kyrgyzstan were the American University of Central Asia (AUCA), the University of Central Asia (UCA), and the Central-Asian Institute for Applied Geosciences. Institutions from other Central Asian countries include Uzbekistan's Hydrometeorological Service and the State Forestry Agency and Kazakhstan's the Kazakh British Technical University and Nazarbayev University. A few universities from the U.S., U.K., and Germany were represented, as was the Institute of Water Problems of Russia and the Institute of Forestry in the Siberian Branch of the Russian Academy of Sciences. Participants also came from the Institute of Atmospheric Physics and the Institute of Tibetan Plateau Research of the Chinese Academy of Sciences, as well as a branch of the Food and Agriculture Organization in Bangkok.

One of the GEWEX program's undertakings is to improve understanding of the impacts of climate variability and change on water availability and food security across mountain ranges and river basins, which dovetails with the challenges facing Central Asia. GEWEX has coordinated with local researchers to host a series of workshops in the region. These have examined the difficulties posed by climate change and what local efforts to address them could look like. Central Asia is extremely vulnerable to climate change. Much of its water resources derive from summer melting of the areas' mountain glaciers and annual snowpack. In a warming world, glacial extent and volume, as well as the snowpack, are declining. Agriculture is an important basis of the region's economies and is highly dependent upon irrigation, but it is also vulnerable to rising growing-season temperatures. For the region to efficiently and effectively adapt to these changes, it needs significantly-improved observational networks and modeling that can provide more useful information for policymakers to invest in climate adaptation.

The major themes for the workshop were:

- Identifying needed existing meteorological, climatological, and hydrological data
- Defining new observational networks–types of data, location of data, etc.
- Developing more relevant climate models for Central Asia and coordination with the development of observational networks

- Identifying specific data needs and potential economic analyses for climate adaptation

The plenary session opened with a welcome from the Rector of Osh State University, Kudaiberdi Kozhobekov, who spoke about ongoing changes at the university. Then the Dean of the International Medical Faculty spoke about satellite data in the context of air pollution and health in the region. Toktogul Mamashov, Head of the Osh Regional Administration of the Ministry of Natural Resources, Ecology and Technical Supervision of the Kyrgyz Republic, addressed regional environmental issues. The plenary session ended with a presentation on GEWEX and the World Climate Research Programme (WCRP) by Peter van Oevelen, director of the International GEWEX Project Office. Michael Brody and Sagynbek Orunbaev gave an introduction and overview of the objectives of the workshop.

Much of the workshop was reserved for the 22 technical presentations, with most available online at https://www.gewexevents.org/meetings/3rd-workshop-central-asia/agenda/ and listed in Annex I. The presentations addressed an array of issues, including various objectives, scales of climate modeling, and the need to understand climate adaptation needs. More of the presentations addressed aspects of water resources than any other general topic. Other subject areas were agriculture, drought, forestry, agro-forestry, and ecotourism. Modeling presentations included scale of resolution, downscaling, and gaps in hydrometeorological, glaciological, and other climate data.

During the afternoon of the second day, we had two breakout groups to summarize what people learned and how this might be used to promote research collaborations.

Challenges Facing a Regional Initiative

There are already many regional research initiatives, but they are typically externally-driven and not as focused on collaboration with other programs. Key issues for this budding regional program are ensuring long-term engagement, investing in the region, and generating projects from within the region.

Related challenges include the reality that there are not many young, capable researchers in the region, and they will often pursue opportunities outside the area. Several participants shared how requirements of some government scholarship programs and opportunities require that recipients return to their country. This is a problem when there are inadequate institutional resources to support good science and reasonable salaries, as often occurs. For local universities, building a strong scientific research program coupled with improved graduate education takes time and assets that are usually allocated to other pursuits. These factors force young scientists to look elsewhere for opportunities.

There was a clearly-stated need for better scientific exchange in the region, particularly where science addresses regional necessities like transboundary water management, etc. In the U.S., there are large annual conferences that are established points for scientific exchange (like the American Geophysical Union Fall Meeting). It would be very useful to establish some equivalent for the region. This can be very expensive, but travel costs to U.S. conferences are very high for Central Asian scientists.

Modeling

Modeling was one of the major discussion points from the workshop, and ranged from considering when models are better than observations to a dive into questions on resolution. Issues around the latter, including the sufficient spatial and temporal resolution required for climate modeling and understanding uncertainty, formed part of the conversation. Currently, participants are looking at eight different climate models running at 25km resolution. Glacier melt is impacting the models, and until this is better understood, higher resolution is not necessary. Re-thinking the resolution of models was a reoccurring theme. An evaluation of biases in regional climate models was called for as well, to determine what the biases are and how they can be corrected. Glacial-hydrological modeling is available to use and may be helpful, as would the potential availability of the supercomputer at the University of Wyoming. High-resolution downscaled historical reconstructions of past climate would be useful as well.

Data

Data was another major workshop theme. Generally, long-term observations of any kind are lacking in the region, but especially those from high elevations. Water isotopes can be used to follow and better understand the water cycle, which may be a helpful resource. Data sharing is a sticking point, as water discharge data is sensitive and the level of cooperation for various hydrometeorological agencies depends on where they are based. Not all data are free, either. Kazakhstan does provide some data online, which is helpful. Practical issues also abound, such as the “loss” of data and results when a project ends, and the need to translate more material into Russian to facilitate its use. In the vein of data access, there are many platforms that provide several types of climate data, but their availability is unpredictable. Open data sharing and maintenance is a good solution, but standardization is important to ensure that the data are high quality.

Collaboration and Ways Forward

Other topics touched on the themes of regional self-sufficiency, with participants noting that concepts, plans, and initiatives should be generated internally rather than externally. There was also an appreciation of just how much research is being conducted in Central Asia, and how the workshop brought many interesting projects to attendees’ attention. Interdisciplinarity was also a subject of discussion. It can stand to be improved, starting first by jointly setting an aim and then identifying which researchers and stakeholders could contribute. Those involved also need to promote increased awareness of the benefits of the research being conducted to foster multidisciplinary collaboration. An interesting note was made at one point that Central Asia is “landlocked” in terms of its livestock genetics.

Participants suggested some solutions to current issues and ways to improve regional research, including holding additional conferences and meetings to successfully connect investigators. More partnerships are needed across entities, including collaborators who are working on future scenarios. Connecting with local agencies, keeping them informed and discussing data and data sharing, is also important. With respect to collaboration, attendees agreed that approaching partnerships with parties jointly setting research targets and including a budget for local staff is a solid way forward. Reaching out to new contacts will help with network building and multidisciplinary cooperation. Shifting mindsets towards a systems approach, where everything is connected, will help researchers include and facilitate complexity.

The Role of GEWEX

GEWEX can potentially play several roles to enable regional research efforts. It can start by facilitating research centers or hubs within disciplines, then act as an umbrella forum to bring the disciplines together in annual meetings. To create these hubs, GEWEX should arrange meetings–preferably with department heads rather than broader university administration–to ensure agreement on this approach before moving forward. Other tasks are encouraging the expansion and improvement of the meteorological station network, glacier monitoring, and water resource monitoring in the region, with a focus on high-altitude areas.

GEWEX could also help with science communication and outreach, as placing that burden on local scientists detracts from their work. GEWEX could regularly publicize research news for Central Asia, perhaps through a series of presentations, a newsletter, or short news email. Ongoing research in Central Asia and climate change impacts in the region should also be highlighted. The Central Asia Research Information Network (CARIN) carries out much of this role currently, so GEWEX should coordinate with CARIN. Generally, more communication and coordination are necessary across languages; often international projects come to the area without understanding what research is currently underway, such as the programming occurring at the local institutes. There is a desire to connect these scientists to more interdisciplinary projects, but no clear way to do so currently. Some participants pointed out that GEWEX is still fundamentally not a local consortium, and so won't generate a sense of local ownership. Others thought GEWEX is the right platform to foster scientific exchange, as GEWEX would start the process and transition it to local parties.

The Role of Osh State University

Osh State University can also participate. Its geographic location close to the Fergana Valley and Mountains, often referred to as the heart of Central Asia, situate Osh State as a potential interdisciplinary, international hub for the region. It could invite others to collaborate and become part of a leading group for Central Asia; possible partners include the American University of Central Asia, the University of Central Asia, the Tien Shan Center, the Central Asia Regional Economic Cooperation Program (CAREC), the Central-Asian Institute for Applied Geosciences (CAIAG), and CARIN. Osh State

University is also developing new research directions, some of which will be relevant to climate science and policy.

Another initiative that the university could undertake is the establishment of a remote sensing data center for Central Asia. It could provide climate data and beyond, branching into agricultural, ecological, and other types of observations. All data should be public and globally accessible.

Near-Term Future Plans

GEWEX planning for workshops and summer schools in Central Asia has already begun. As recommended, this is being coordinated with CARIN (Geoffry Henebry, Michigan State University, and CARIN Regional Coordinator, Sagynbek Orunbaev, AUCA). Additional planning is taking place with the University of Wyoming, as it prepares for its regional downscaling modeling endeavor for Central Asia.

GEWEX is now in the early stages of building this effort into a formal Regional Hydroclimate Project by current co-leads, Michael Brody and Sagynbek Orunbaev.

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ANNEX I

List of Presentations

Titles and Authors of Presentations

RS-GIS-GEE with MAR applications for climate change mitigation in agriculture
Raushan Amanzholov and Janay Sagin

Towards a network of critical zone observatories in Central Asia
Florian Betz

Bayesian decision for runoff evaluation in nonstationary condition
Mikhail Bolgov

Water infrastructure planning with the high uncertainty of future water quantity
Michael Brody and Bekhzod Ergamberdiev

FEWS NET in Central Asia/Afghanistan
Mohammad Fahim Zaheer

High-resolution dynamic downscaling of historical and future climate projections over Central Asia
Erkin Isaev, Akihiko Murata, Shin Fukui, and Roy Sidle

Agricultural drought over water-scarce Central Asia
Jie Jiang and Tianjun Zhou

The Project for development of a satellite data and a regional chemical transport modeling-based air pollution assessment system and formation of a research center for air pollution studies
Roman Kalmatov

Spatio-temporal patterns of different tree species response to climatic factors in south Kyrgyzstan
Maksim Kulikov, Evgenii Shibkov, Erkin Isaev, Azamat Azarov, and Roy Sidle

Earth observation in the age of AI and Big Data
Min Feng

Enhancing climate resilience in high-altitude regions: Addressing data gaps and modeling challenges in Central Asia's mountainous terrain
Sagynbek Orunbaev

Potential orobiome distribution over the South Siberian and North Mongolian Mountains associated with predicted climate change by the mid-century
Elena Parfenova and Nadja Tchebakova

Creating use-inspired dynamically downscaled projections of future climate across Central Asia: From the physical to the social sciences
Stefan Rahimi and Callie Berman

Assessment of the water balance components using energy and mass balance models in small glaciated catchments of the Central Tian-Shan, Kyrgyzstan
Sanjar Sadyrov

Hydrometeorological and glaciological monitoring in Central Asia: Historical data, new data sets, and perspectives
Zarina Saidaliyeva and Maria Shahgedanova

The current and future role of GEWEX in the Central Asia Region
Peter van Oevelen

Sustainable agroforestry value chains for climate change adaptation in Central Asia
Jannike van Bruggen and Philip Schierning

Adaptation and ecotourism: Shifting temperatures and their effect on tourist destinations
Valerie Varco

Baseline water basins research–Kazakhstan perspective
Vadim Yapiyev

Anthropogenic forcing to long-term changes of Central Asian precipitation
Tianjun Zhou

Метеорологические и гидрологические наблюдения в Кыргызстане: проблемы сбора данных, их качество и перспективы решения (Meteorological and hydrological observations in Kyrgyzstan: Problems of data collection, their quality, and prospects for solution)
Azamat Osmonov

Archaeology and paleoecology of high-altitude ecosystems in Central Asia’s landlocked mountains during the Late Glacial to the middle Holocene (2023–2027)
PaleoCalm, Osh State

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