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FLASH FLOOD AND MUDFLOW RISKS IN THE ABEC CORRIDOR, FROM AN ISSYK-KUL PERSPECTIVE. METHODS, TOOLS, AND MEASURES.

4th CAREC Climate Change Working Group Meeting.

Eduardo García Alonso. Climate change specialist.

Bishkek, 7-9 April 2025

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1- BACKGROUND

BACKGROUND

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Background reports related with climate risks and adaptation measures in the CAREC region (2024-25):

- Preliminary Design of a Multi-hazard Early Warning System and Complementary Measures in the Almaty-Bishkek Economic Corridor. Technical Report.
- Preliminary Risk Assessment of Border Crossing Points in the CAREC Corridors. Technical Report.
- Field Visit to Border Crossing Points and other Facilities in the Regions of Osh and Jalal-Abad (Kyrgyz Republic). Mission Report.
- Field Visit to Border Crossing Points and other Facilities in Andijan Region (Uzbekistan). Mission Report (in progress).

POTENTIAL HAZARDS IN THE CAREC REGION

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Rapid onset:

- Earthquake
- Landslide
- Avalanche
- Mudslide
- GLOF [1]
- Floods

Slow onset:

- Waterlogging [2]
- Drought
- Land subsidence
- Riverbank erosion
- Extreme wind
- Wildfire

Some hazards affect only specific spots (landslides), while others can affect large areas (waterlogging, land subsidence) or even the whole territory (earthquakes).

Water in its different shapes (ice, snow, rainfall, groundwater, soil and air humidity) is relevant in most of them, except earthquakes and extreme winds.

[1] *Glacier Lake Ourtburst Flood*
[2] *Flooding due to groundwater outcrops*

RISK REDUCTION MEASURES

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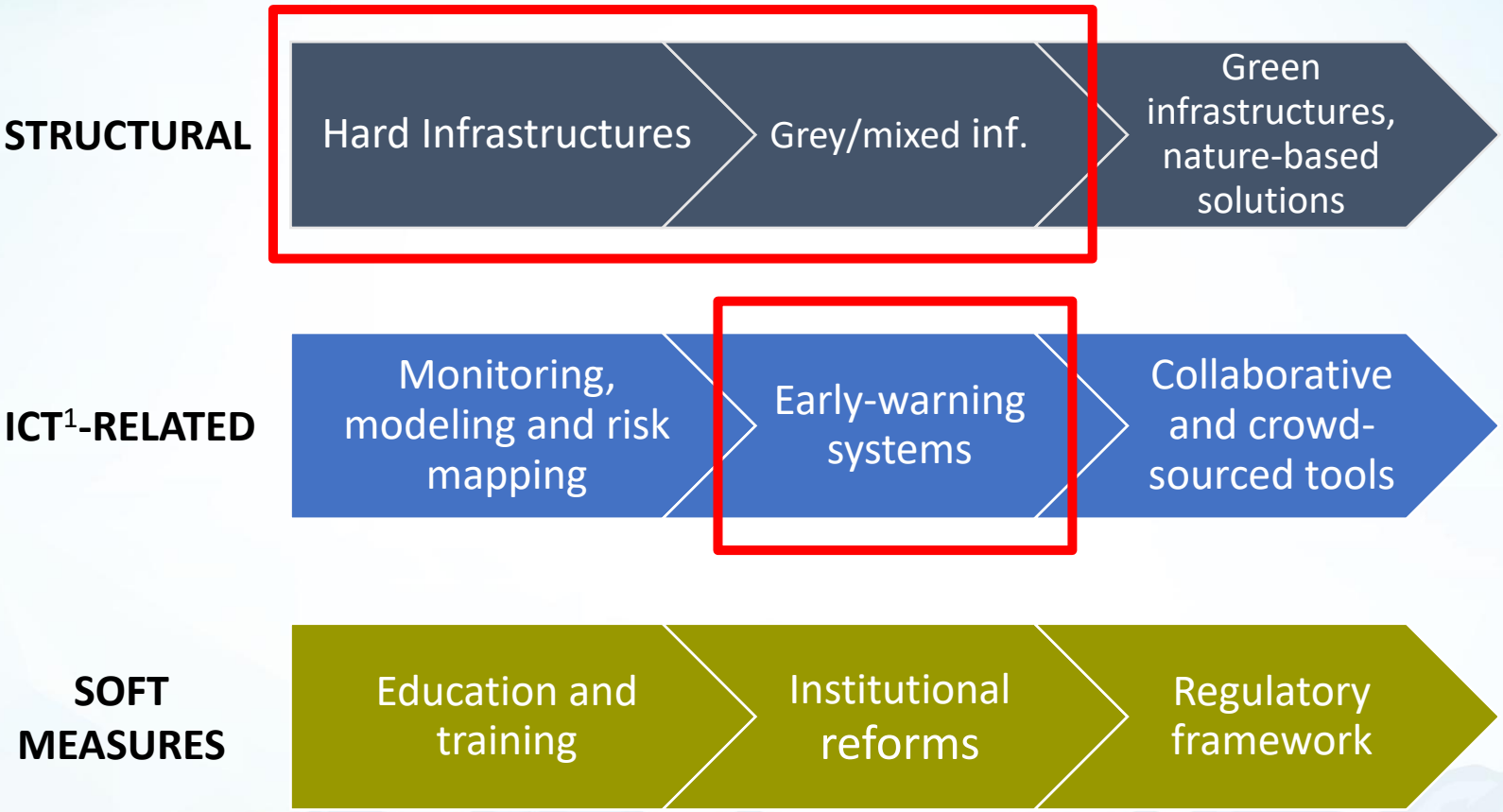

[1] *Information and communication technology*

2- PRELIMINARY RISK ANALYSIS OF LAKE ISSYK-KUL (KYRGYZ REPUBLIC)

LAKE ISSYK-KUL

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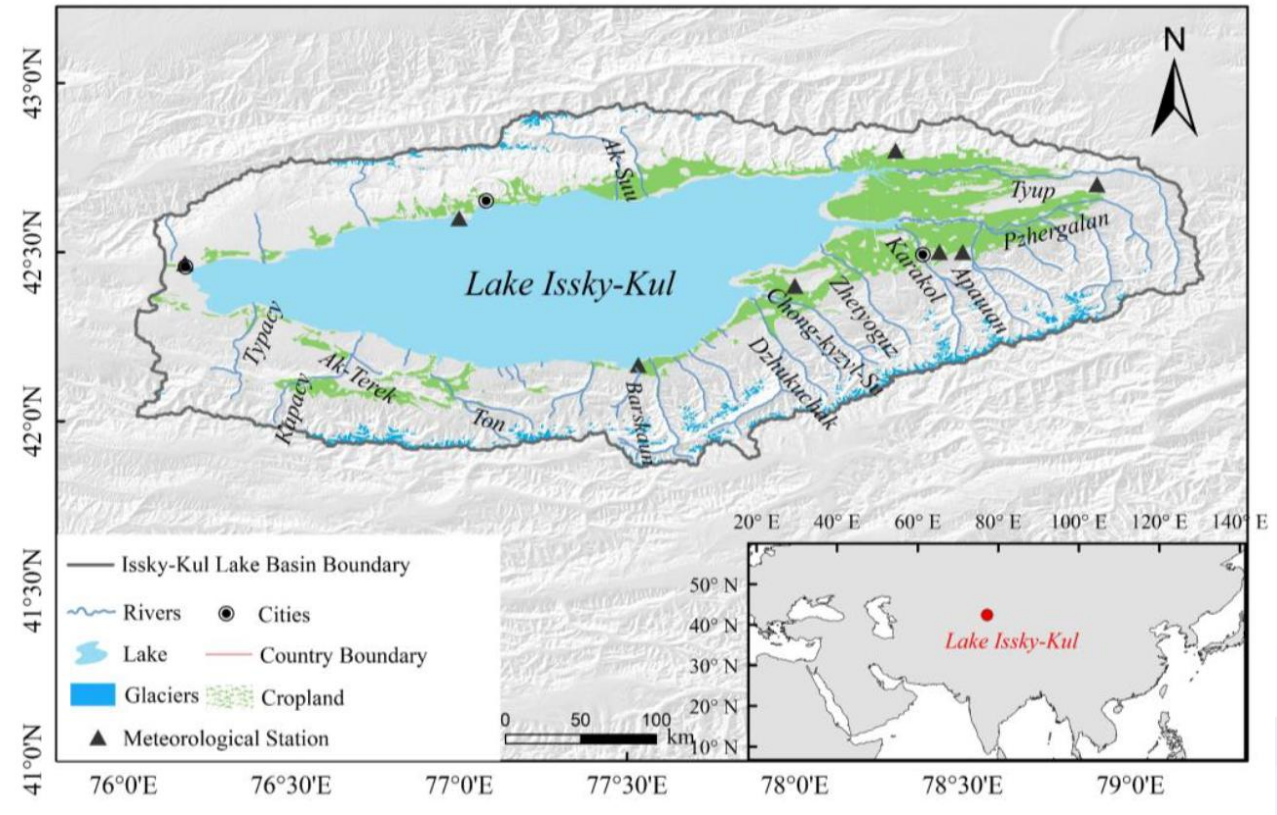
Issyk-Kul Lake is the tenth largest lake in the world by water volume and an important water resource in the Kyrgyz Republic.



Despite concerns about water quality due to tourism and agriculture, the lake remains oligotrophic with high dissolved oxygen levels. Understanding lake dynamics is crucial for sustainable management of this important economic and ecological resource.

LAKE ISSYK-KUL

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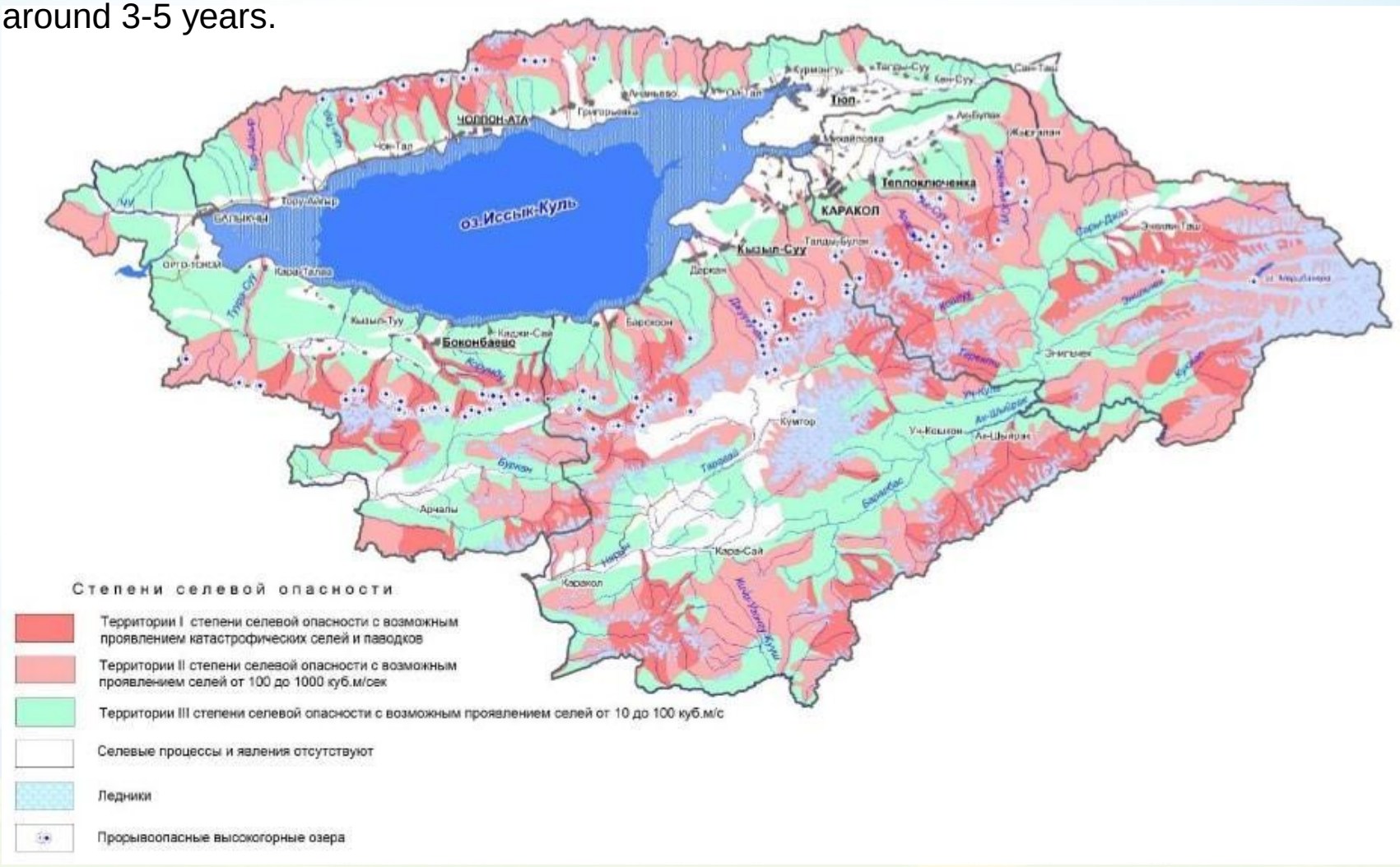
The historical return period of the mudflows within Issyk-Kul depression zone is around 3-5 years.



RECENT DESASTERS

The GLIDE repository includes **two recent events** in the Issyk-Kul region. On **August 7, 2023**, around 17:00 hours, mudflows occurred in the villages of Ken-Suu, Bayzak, Taldy-Suu, Korumdu, and Koochu in the Tup district of the Issyk-Kul region due to short-term rains. 200 households were directly impacted by the disaster, but preliminarily 60% of total 13,000 population of 5 villages were in need of assistance of various degrees.

In **August 2024**, powerful mudslides caused by heavy rains caused damages in Kyrgyz Republic's northern Issyk-Kul region. The mudflows descended in several locations in the south and north of the Issyk-Kul region, flooding highways and mountain passes. In the town of Cholpon-Ata, water from the canal reportedly flooded the streets.

CLIMATE CHANGE. AVERAGES

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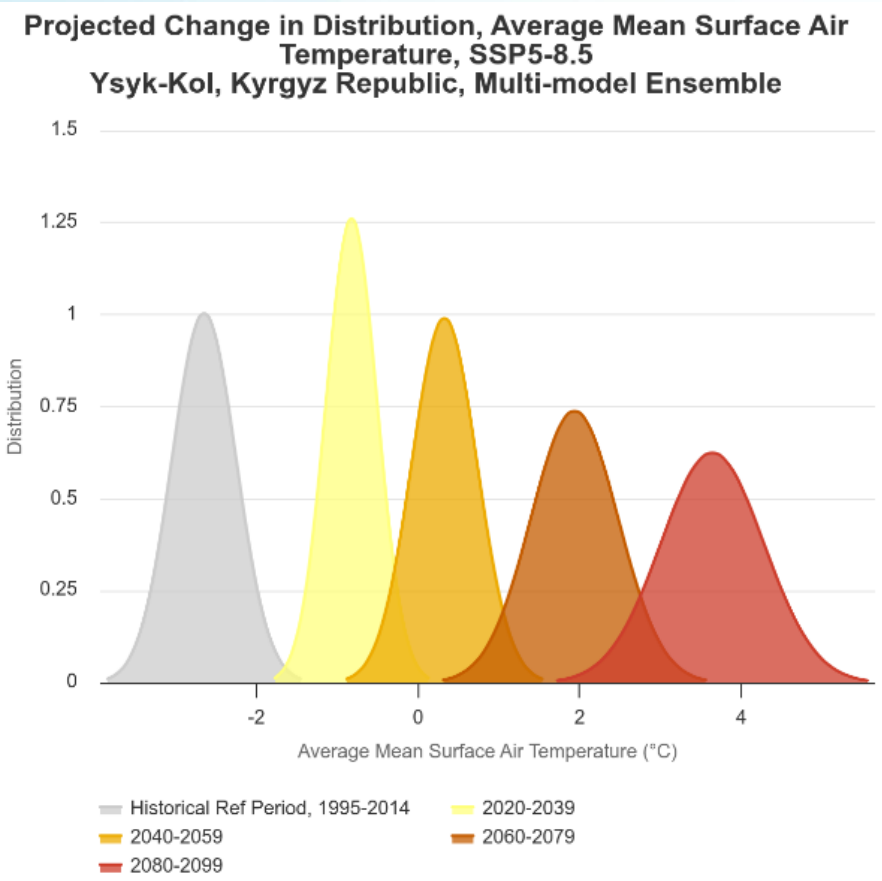

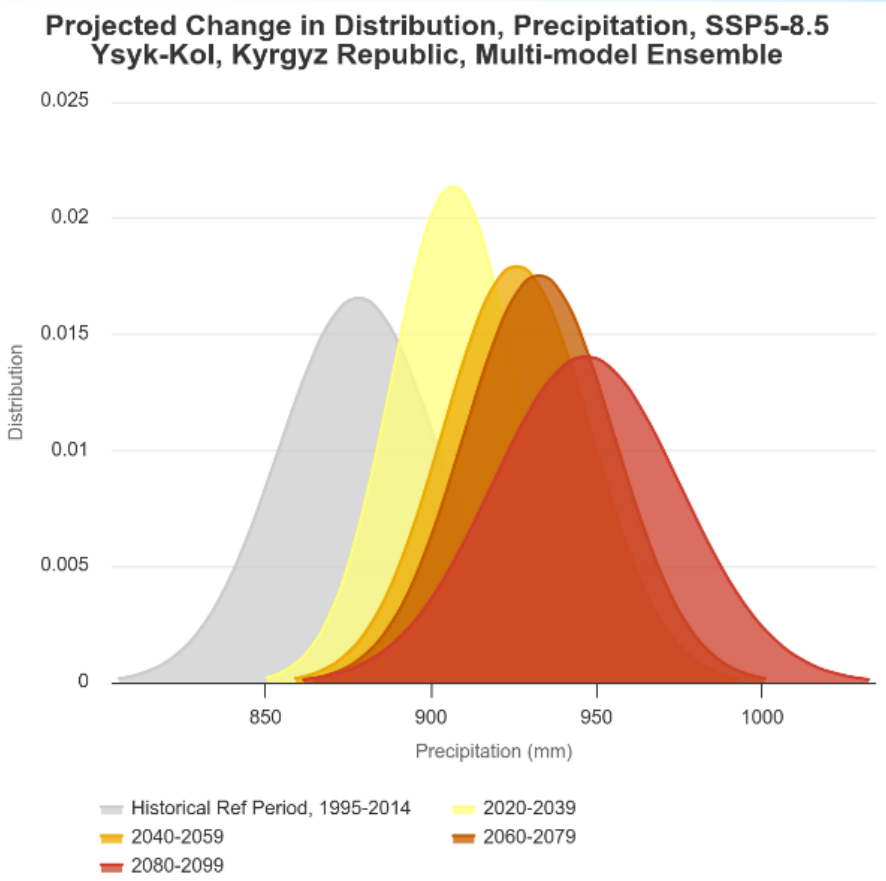

Climate projections for Issyk-Kul show higher temperatures (left) and also precipitation (right). Mountain areas have more uncertainty and climate variability than plains.

Source: WB Climate Change Knowledge Portal.

CLIMATE CHANGE. SEASONALITY AND EXTREMES

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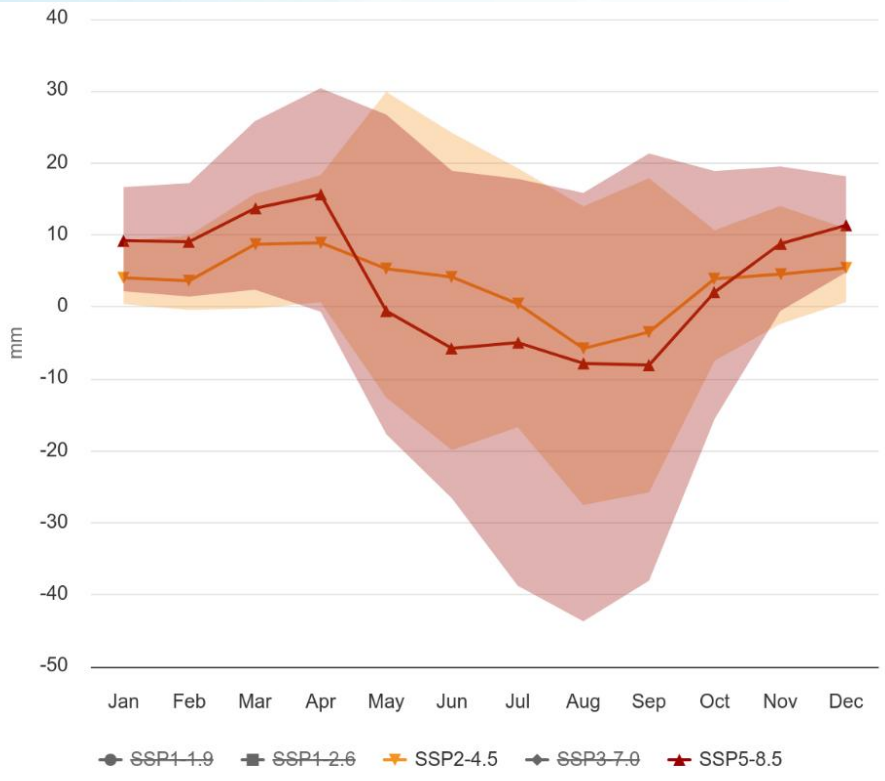

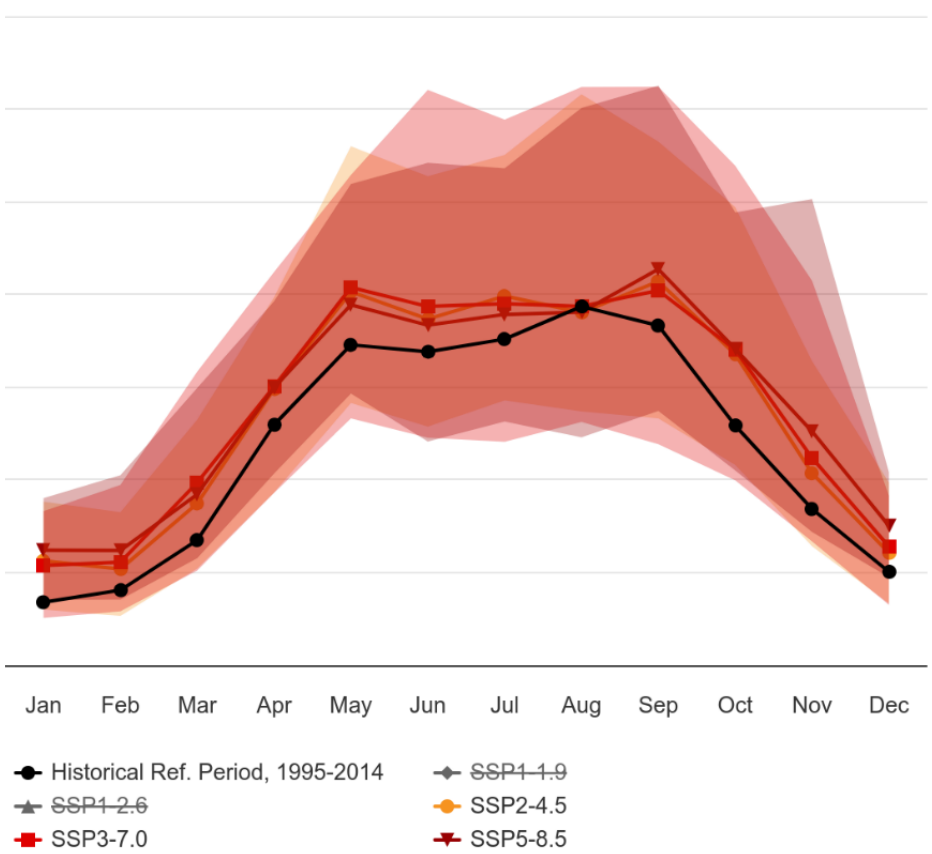

Projected changes in monthly precipitation anomaly (left) and largest 1-day precipitation (right) in Issyk-Kul province (2060-2079).

Source: WB Climate Change Knowledge Portal.

CLIMATE CHANGE EFFECTS ON PEAK RIVER FLOWS

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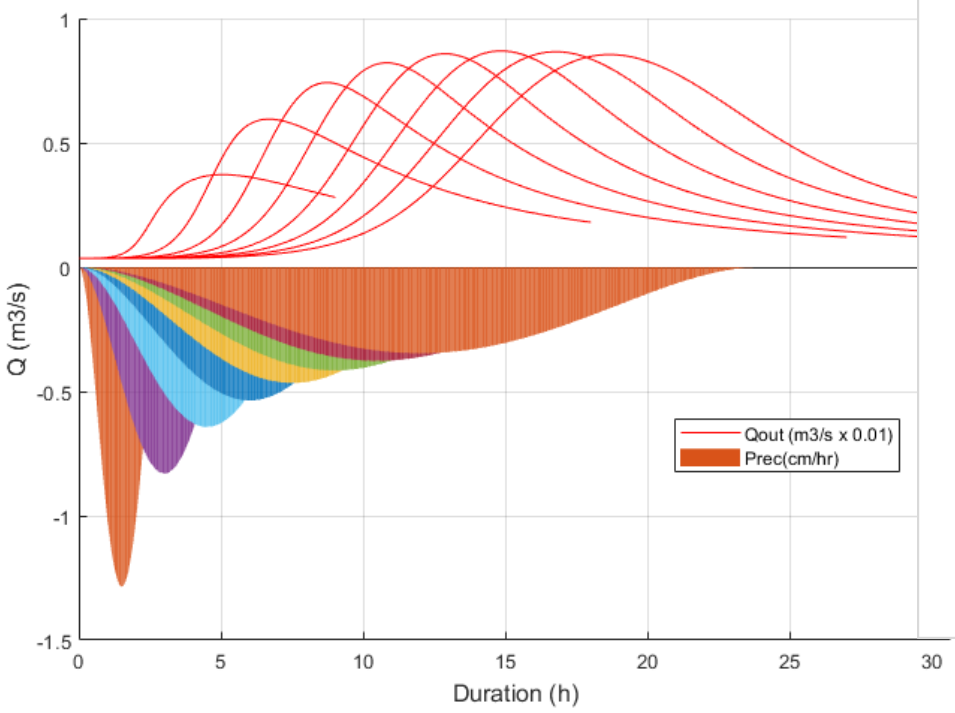
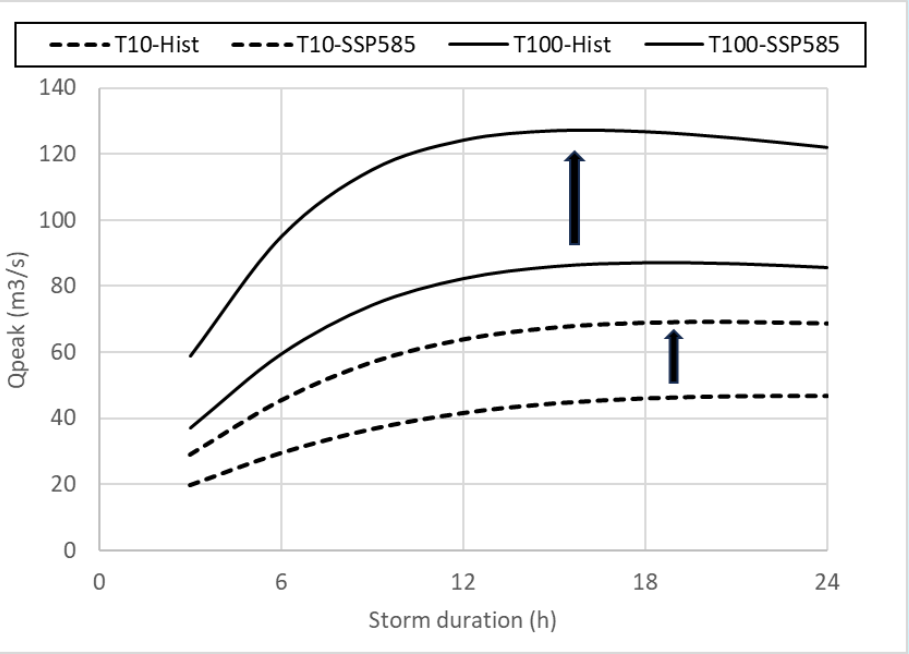


Hyetographs (neg. Y-axis) and associated hydrographs (pos. Y-axis) for storms with duration between 3 and 24 hours (3-h interval).



Peak discharge of the hydrograph generated by rainfall events with duration expressed in the X-axis and Tr=10, 100 years. The arrow shows the increase due to climate change on the peak discharges.

CHANGES IN SEASONALY AND INTENSITY OF KEY HAZARDS

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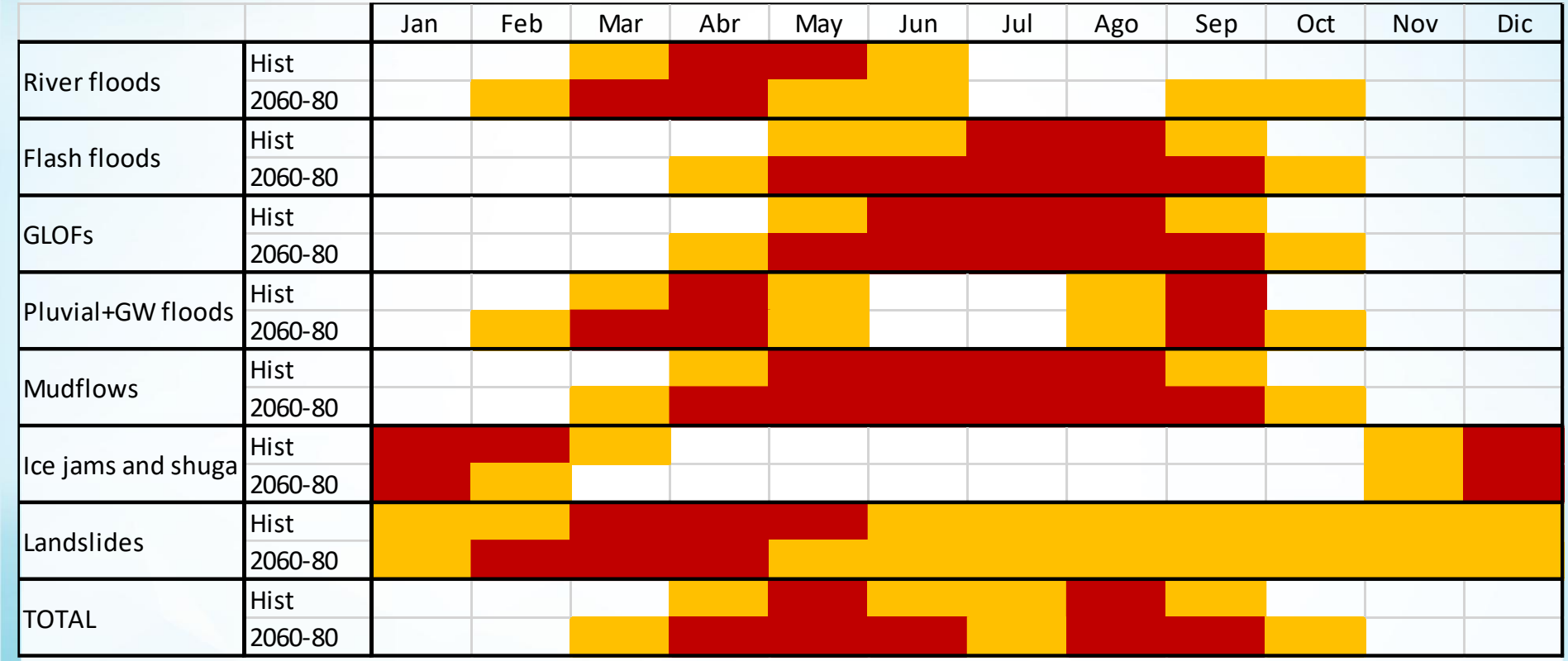

Notional evolution of the seasonality of water-related risks in the ABEC area, for the historical climate and with 2060-80 projected climate. Yellow and red indicate moderate and high qualitative risk, respectively.

MAIN CHALLENGES (1 / 2)

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Issyk-Kul Lake and the surrounding area is an iconic enclave in the Kyrgyz Republic and one of Central Asia's tourist destinations. As the world's second-largest alpine lake (after Lake Titicaca), Issyk-Kul is renowned for its beauty, clear waters, and unique geographical features.

As in other places experiencing a surge in popularity and visitors, environmental problems are growing faster than the public resources and infrastructure needed to deal with them:

- **Water Pollution.** Issyk-Kul lake faces pollution from untreated wastewater, agricultural runoff, and tourism-related waste. Increased pollution threatens the lake's ecosystem and biodiversity, which is vital to the region's tourism industry.
- **Waste Management.** The region lacks an effective waste management system. The influx of visitors contributes to waste generation, particularly plastic and other non-biodegradable materials, and the region struggles to properly manage it.

MAIN CHALLENGES (2 / 2)

- **Deforestation and Land Degradation**: Overgrazing by livestock and deforestation due to the need for firewood in rural areas have led to land degradation and soil erosion. This reduces agricultural productivity and contributes to desertification in some parts of the province. It also increases peak runoff and mudflow/landslide risks.
- **Mining and Industrial Activities.** There is concern about the environmental impacts of mining activities in the region, particularly around gold extraction. Mining can lead to water and soil contamination, affecting local communities and ecosystems. Gold mining activities near Issyk-Kul pose a contamination risk, particularly related to uranium waste and heavy metals, although containment measures are in place.
- **Natural risks and climate change**. On the top of this, there are all the risks and uncertainties associated with climate change, as previously discussed in this report.

MONITORING AND EARLY WARNING SYSTEMS

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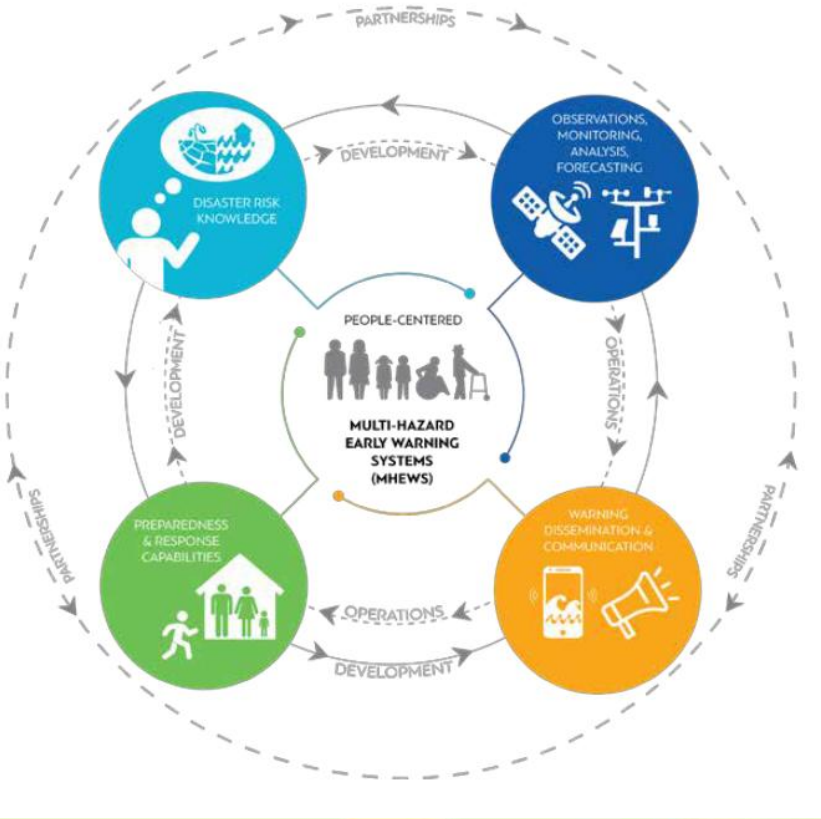
An early warning system (EWS) is an integrated system and process of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events.

- **Pillar 1:** Disaster risk knowledge
- **Pillar 2:** Observations, monitoring, analysis, and forecasting
- **Pillar 3:** Warning, dissemination and communication
- **Pillar 4:** Preparedness and response capabilities



INFORMATION AND DECISION SUPPORT SYSTEMS

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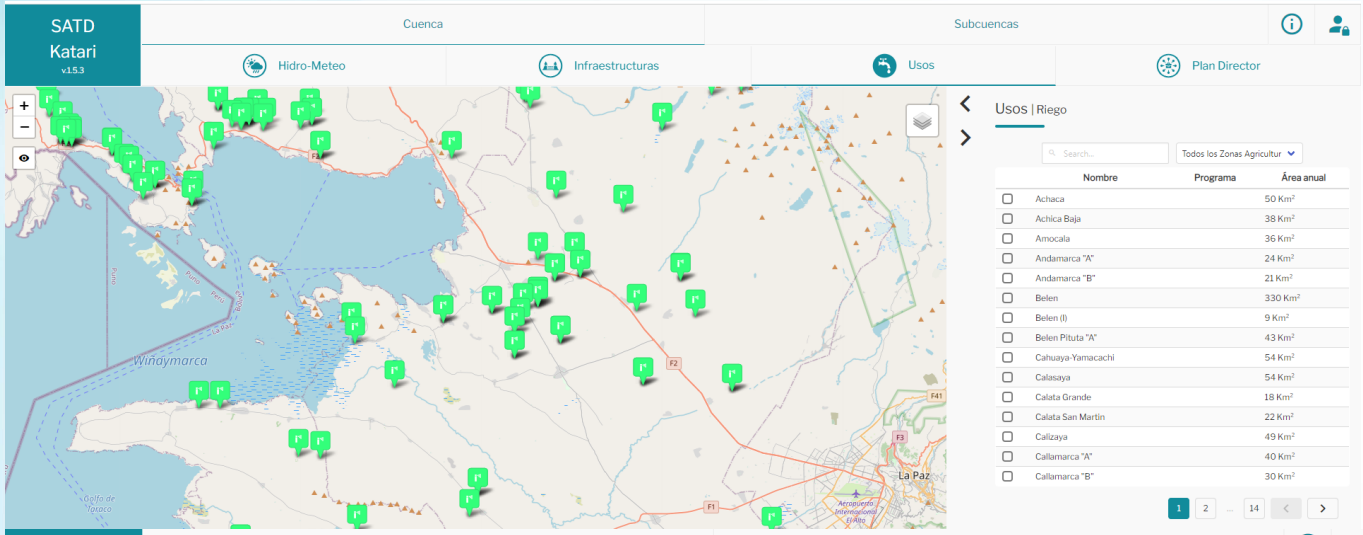

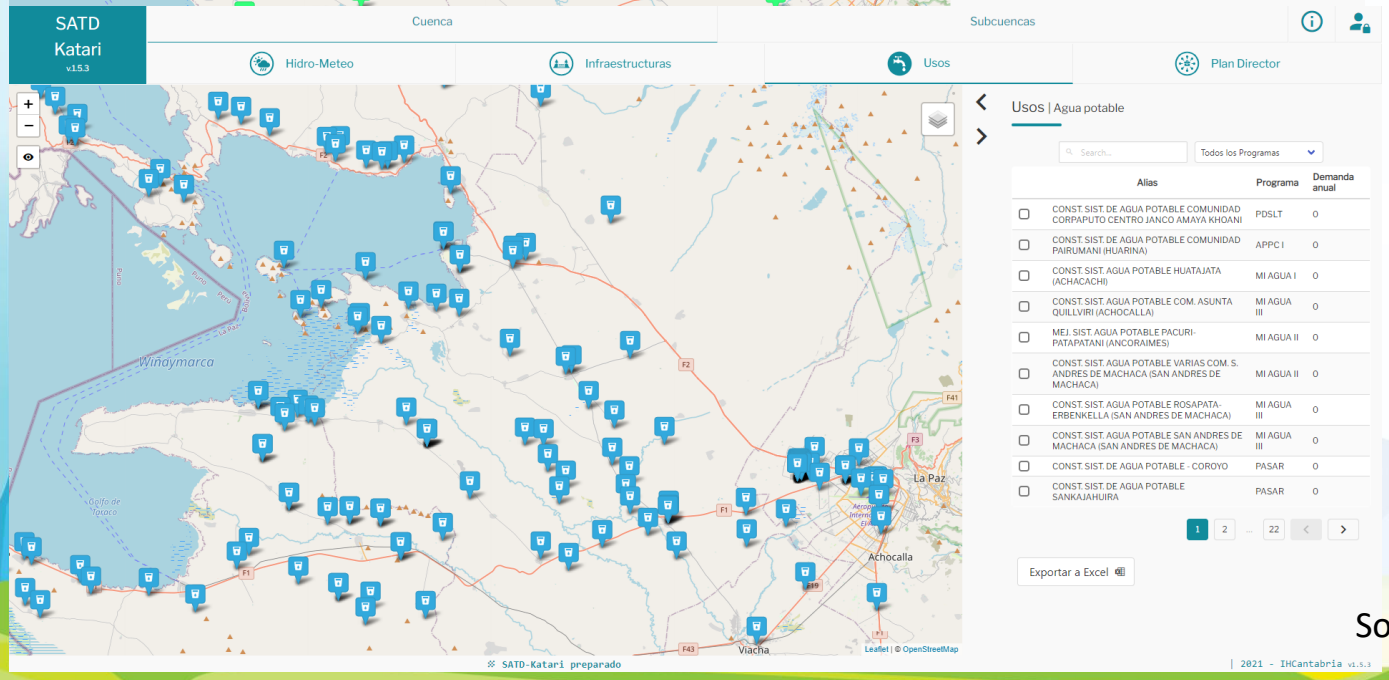

Decision support system for Lake Titicaca (Bolivia), including information on water uses and hydro-climatic variables.

Source: Inter American Dev. Bank

INTEGRATED COASTAL ZONE MANAGEMENT IN LAKE ISSYK-KUL

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The main topics and activities that should be included in an ICZM plan for Lake Issyk-Kul are summarized below:

1. Introduction
2. Environmental Assessment
3. Socio-Economic Context
4. Stakeholder Engagement and Institutional Coordination
5. Integrated Management Strategy
6. Climate Change Adaptation Measures
7. Economic Development and Sust. Tourism
8. Monitoring, Evaluation, and Enforcement
9. Funding and Capacity Building
10. Conclusions

3- BENCHMARKING AND PRELIMINARY RISK ASSESSMENT AT CAREC BORDER CROSSING POINTS

CHARACTERIZATION OF BCPs

- **ID:** The identifier of the BCP expressed as BCP-X, where X is a correlative number.
- **Countries:** The bordering countries at the BCP.
- **CAREC corridors:** The code of the CAREC corridors traversing the BCP, according to the CAREC transport strategy 2030.
- **Transport modes:** Road and/or Railway
- **Flood risk:** An initial estimate of the flood risk in the area, using the available hazard data as proxy (see below). It has three levels: low, medium or high.
- **Landslide risk:** An initial estimate of the landslide risk in the area, using the available hazard data as proxy
- **Socioeconomic importance:** it is a first guess of the intensity of goods and people going through the BCP and its criticality. Related with the amount of CAREC corridors using such BCP.
- **Accessibility:** It is a practical assessment of how difficult it is to reach the BCP for logistical purposes (low, medium or high).
- **Risk Level:** It is a final score (1-5) that reflects how critical a particular BCP is with respect to natural hazards, based on the above factors.

CHARACTERIZATION OF BCPs

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PRIORITIZATION OF BCPs FROM A CLIMATE RISK PERSPECTIVE

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ID	Countries	CAREC corridors	Risk level (1:low-5:high)
BCP-1	AZE-GEO	2a,b,c	3
BCP-2	KAZ-KGZ	1c, 3b	3
BCP-3	KAZ-KGZ	6d	1
BCP-4	KAZ-TKM	3a, 6b,c	2
BCP-5	KAZ-UZB	2a, 6a	2
BCP-6	KGZ-TAJ	2d, 3b, 5a,c	4
BCP-7	KGZ-UZB	2a,b	5
BCP-8	TAJ-UZB	3b	3
BCP-9	TAJ-UZB	6c	2
BCP-10	TAJ-UZB	6b	5
BCP-11	TKM-UZB	2b,d, 3a	3

RISK LEVEL RESULTS AT BCPs

- BCP-6: the connection between Osh (KGZ) and Dushanbe (TAJ) at Karamyk.
- BCP-7: the connection between Osh region in the KGZ Republic and the Fergana Valley (UZB) at Dostuk.
- BCP-10: the connection between Samarkand (UZB) and Dushanbe (TAJ) at Panjakent.

Image of the Ak-Buura river in Osh during the floods in July 2024.

BCP-6. PROPOSED MEASURES IN JALAL-ABAD AND OSH REGIONS (KGZ)

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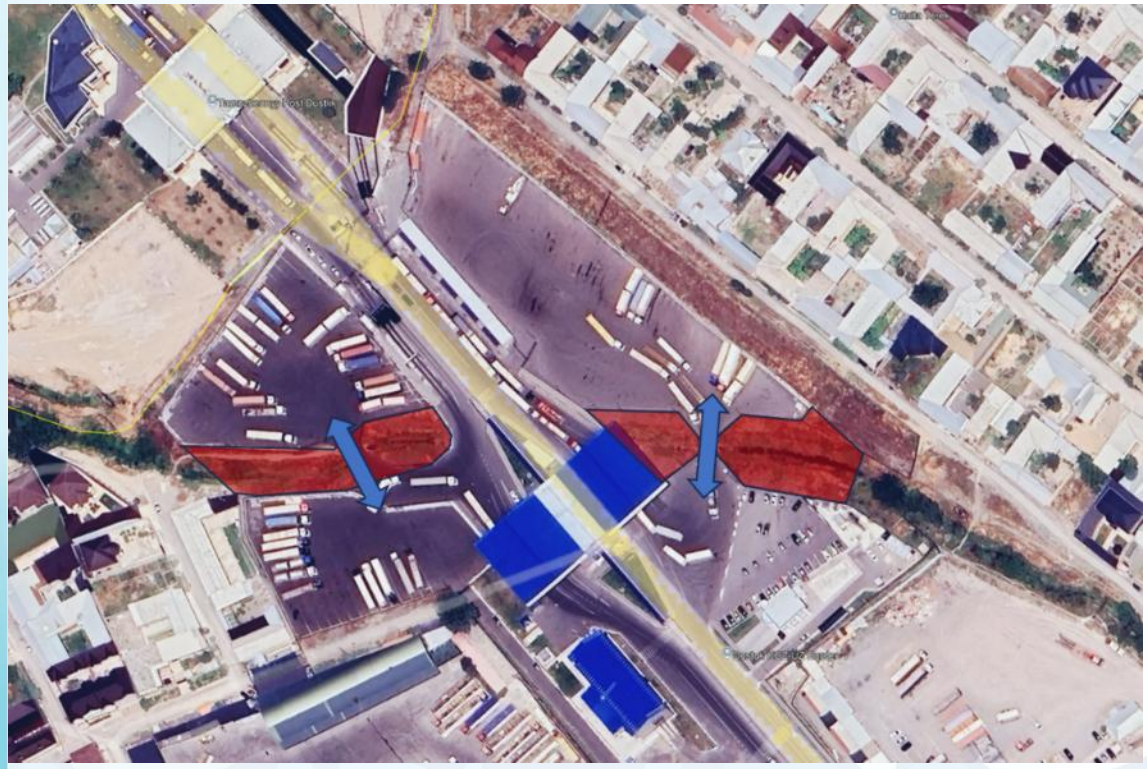
BCPs at Dostuk and Kara-Suu



BCP at Dostuk with the parking areas that could be gained by burying the existing canal, highlighted in red (traffic bottlenecks are indicated with blue arrows).

BCP at Kara-Suu.

BCP-6. PROPOSED MEASURES IN JALAL-ABAD AND OSH REGIONS (KGZ)

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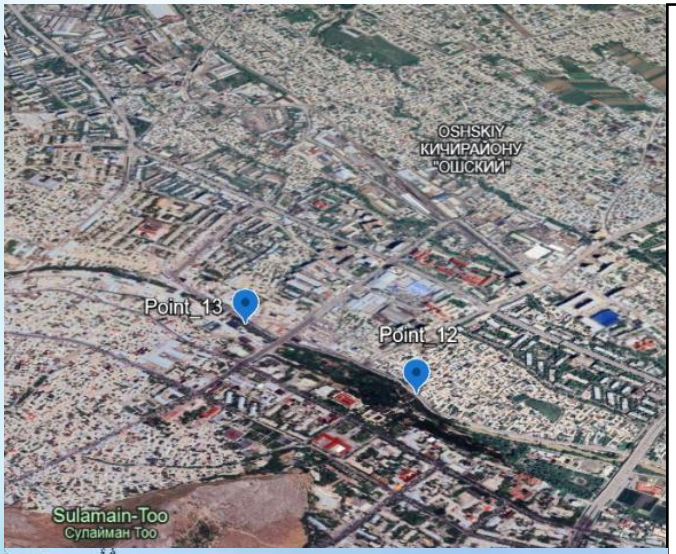
Ak-Buura River corridor.



Recommendations:

- The urban sector of Ak-Buura River next to the Osh Bazaar should be redesigned to withstand present and future floods, including climate change effects on maximum precipitation. Several bridges need retrofit and some sectors need relocation of assets.
- Small catchments as the ones including points 11 and 15 need to enforce a protection strip on both sides of the river, together with other measures as retrofitting of river crossings and creation of upstream sediment storage and water detention basins.
- The operation of the Ak-Buura irrigations canals should be automated, and they should receive information of the situation of the upstream reservoir, to reduce damages of potential floods.

BCP-6. PROPOSED MEASURES IN JALAL-ABAD AND OSH REGIONS (KGZ)

Kugart River corridor.

Erosion in Kugart river near Jalal-Abad. probably induced by upstream sediment extraction.

An ephemeral stream going through the middle of a newly colonized area in the outskirts of Jalal-Abad.

Recommendations:

- Sand mining from the river bed should be based on a comprehensive analysis of the key morphodynamic processes and sediment budget.
- Zoning of the river floodplains should be enforced, and new settlements should only be allowed beyond the flood-prone areas.
- Rice cultivation, although a traditional activity in the area, seems ill-suited in the face of regional water stress and the looming climate crisis.

BCP-6. PROPOSED MEASURES IN JALAL-ABAD AND OSH REGIONS (KGZ)

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Kara Darya River corridor (Kyrgyz sector)

One of the several sediment traps in the hills north of Kara-Darya village

Recommendations:

- There is clear potential for improvement in the planning of the releases from Andijan reservoir, even without further protection works. For instance, the releases should take into consideration the discharges in the Kugart river, to avoid the coincidence.
- An ecosystem-based approach could be tested in the hills north of Kara-Darya village, since soil erosion is mainly human induced (grazing).
- The existing provisional embankment could be reinforced to withstand higher discharges.

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Thank you!