Impacts of climate warming on glaciers and water resources in Tajikistan and Central Asia

Presentation by Nailya MUSTAEVA

Agency on Hydrometeorology and Environmental Monitoring of Tajikistan
Central Asia: mostly arid hot desert area, two vital rivers, 10% mountains

Total glacier area around 12,000-14,000 km², estimated glacier volume 1000 cub.km

**GLACIERS in Central Asia are:**
- essential water supplies for **agriculture and hydropower, especially in dry years**
- key **tourist destinations and mountain sport** sites
- sources of **GLOFs and floods**
Mountains are the main water towers of Central Asia
And glaciers are important reservoirs of frozen water

Zeravshan glacier, Tajikistan
Amu Darya riverheads: water jets are coming from a Pamir glacier terminus to form the major river system of Central Asia – AMU DARYA
Temperatures are increasing in most mountain regions of Central Asia.

Air temperatures in high altitude and nival-glacier zones are projected to increase into the 21st century by 1-3°C.

Such increase may have very dramatic effect on glaciers and water resources.
Under current climate warming conditions, glaciers of Central Asia are retreating fast!

Tajikistan: Hissaro-Alai and Pamir Mountains

Kyrgyzstan and Kazakhstan: Tien Shan Mountains
Change in surface area of Central Asian glaciers in the last half of the 20th century

- melted area as % of the initial glacier area

Tien Shan

Gissar Alai

Snow-glacier area in the basin of Fedchenko glacier

AFGHANISTAN Pyanj River’s left bank

Compilation of data from V. Dikih, U. Pilgui, A. Yablokov
Glaciers play very important role in water supply in Central Asia (on average 10-30%). Due to climate warming, some glaciers have completely disappeared in the recent decades.

Formerly glacier - currently dust

Due to climate warming, some glaciers have completely disappeared in the recent decades.
Cross-links: climate change, glaciers, water, disasters

Alaudin post glacial landscape and lakes
Glaciers and natural hazards: rising water levels in lakes and rivers

**Rapid melt of glaciers may increase the risk of natural disasters. Sarez Lake and many glacial lakes could become more dangerous. Risk of sudden floods due to GLOFS and water level rise in rivers may increase**
Glaciers provide bulk of water in dry hot summers. When they vanish, water dependent sectors of Central Asian economies could experience great difficulties, if timely adaptation measures are not implemented.
Change in glacier volume in Tajikistan

<table>
<thead>
<tr>
<th>Glacier Volume, cub.km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle 20th century</td>
</tr>
<tr>
<td>End 20th century</td>
</tr>
<tr>
<td>Middle 21st century</td>
</tr>
</tbody>
</table>

Forecast

Source: Tajik Agency on Hydrometeorology and Environmental Research

Impacts of climate change on river flow in Central Asia

<table>
<thead>
<tr>
<th>Average Annual River Flow, cub.km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amu Darya</td>
</tr>
<tr>
<td>Syr Darya</td>
</tr>
</tbody>
</table>

Now
Mild warming
Significant warming

Reduction in river flow according to models by the period 2030-2050

Source: Tajik Agency on Hydrometeorology
Hydropower and irrigation are very dependent on glacier water.