



# **CHANGING WATER RESOURCES OF THE RIVERS IN KAZAKHSTAN AS A RESULT OF CLIMATE CHANGE IMPACTS**

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# Kazakhstan



The Republic of Kazakhstan is located in Eurasia and ranked as the ninth largest country in the world. It is also ranked the world's largest landlocked country, its territory of 2,727,300 km<sup>2</sup>. It is neighbored clockwise by Russia, China, Kyrgyzstan, Uzbekistan, Turkmenistan, and also borders on a significant part of the Caspian Sea.

# The Climate of Kazakhstan



- ✓ The climate of Kazakhstan is typically continental, with cold dry winters and hot dry summers. Precipitation varies between arid and semi-arid conditions.
- ✓ Deserts and steppes account for more than 80 % of the total area.
- ✓ The continental climate is also characterized by its high evaporation level, which, together with the low rainfall, makes irrigation a necessity in large parts of the country, notably in the south.

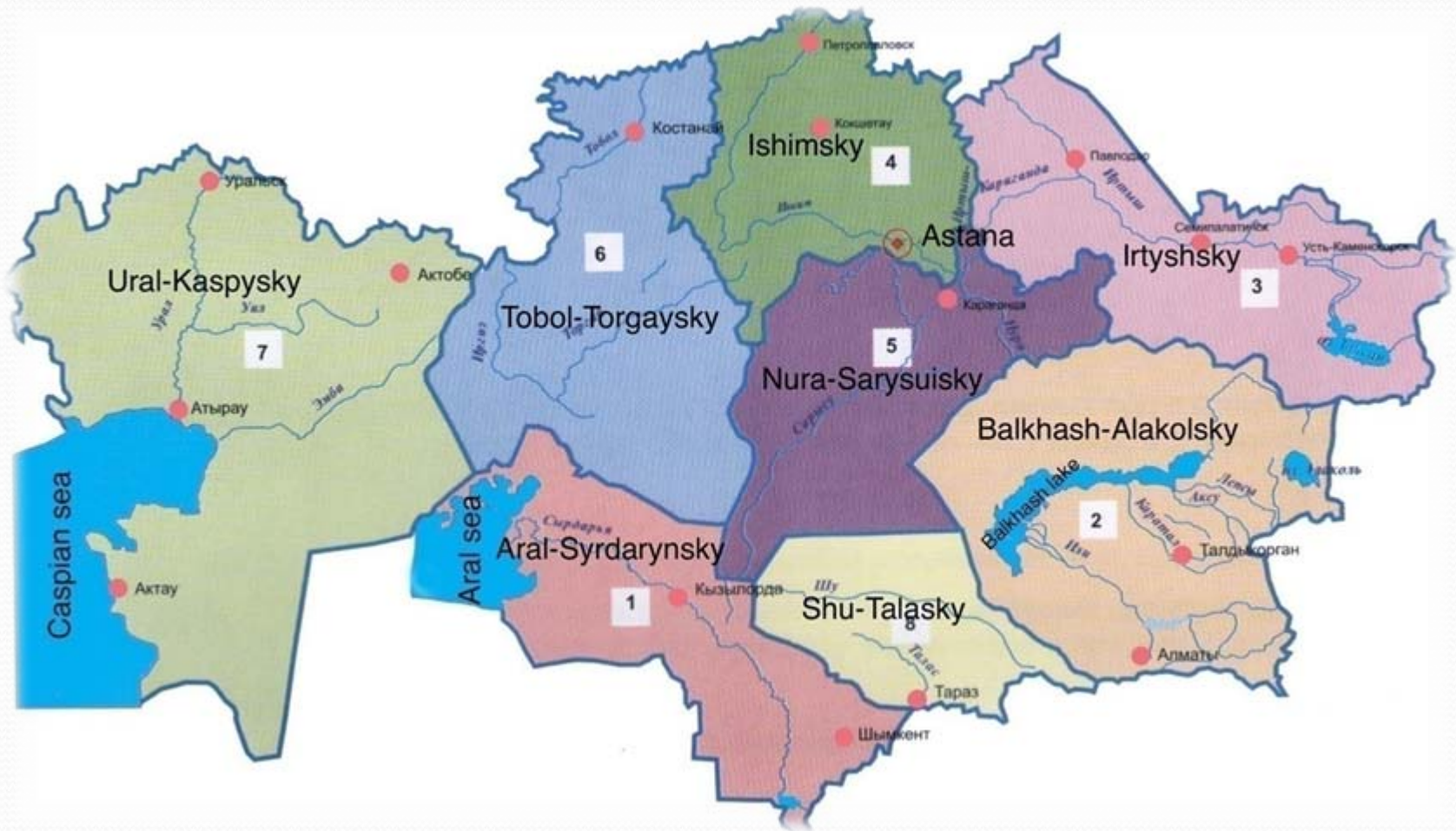
# Water Resources of Kazakhstan

The Republic of Kazakhstan is relatively poor in water resources, which non-uniformly distributed on territory. The fresh water deficit is the most significant environmental problem making difficult sustainable development of Kazakhstan.

The total water river resources in the year with an average water content make  $109 \text{ km}^3$ , and only  $58,9 \text{ km}^3$  of them is a local resources, but  $48,9 \text{ km}^3$  is a transboundary resources.



# Hydroeconomic Basins of Kazakhstan



**Kazakhstan is divided on 8 Hydroeconomic basins :**

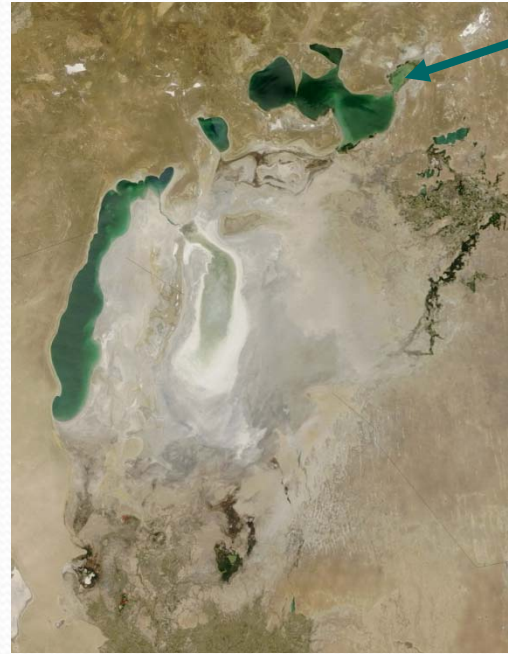
Aral-Syrdarynsky, Ural-Kaspysky, Ishimsky, Nura-Sarysuisky,  
Tobol-Torgaysky, Irtyshsky, Balkhash-Alakolsky, Shu-Talasky basins

# The Largest Lakes/Seas of Kazakhstan



## Caspian Sea:

Area – 392 600 km<sup>2</sup>  
Volume – 78 650 km<sup>3</sup>  
Average depth – 208 m,  
Maximal depth – 1025 m  
Mean sea level – minus 27,15 m BS



## Small Aral Sea

Area – 3252 km<sup>2</sup>  
Volume – 27 km<sup>3</sup>  
Mean Sea level – 42 m BS



## Balkhash Lake

Area – 16500 km<sup>2</sup>  
Volume – 112 km<sup>3</sup>  
Mean Sea level – 340 m  
Average depth – 5,8 m  
Maximal depth – 26 m

# Water Resources Deficit

The water resource deficit causes are

- ✓ the natural conditions (90 % of the river runoff takes place during the spring period),
- ✓ formation of about half of the flow on the territory of neighboring countries,
- ✓ extensive use,
- ✓ excessive unrecoverable water consumption for irrigation,
- ✓ water losses.

In addition, the surface water resources in the republic are distributed extremely unevenly are subjected to considerable time fluctuations.

# Some Examples of Unreasonable Using Water Resources

- ✓ ***enormous water losses*** – all of the channels are open. It is big losses because of evaporation, and most of them are sandy channels. It is really big losses because of filtration.



- ✓ ***Many channels are out of condition***





# Some Examples of Unreasonable Using Water Resources

## ✓ ***Water pollution:***

It is not only chemical pollution from factories, agriculture, communal services and other, also it is rubbish.



# Impacts of Climate Changes on Water Recourses

In the half of the 21-st century surface water resources can be affected by anthropogenic climate changes.

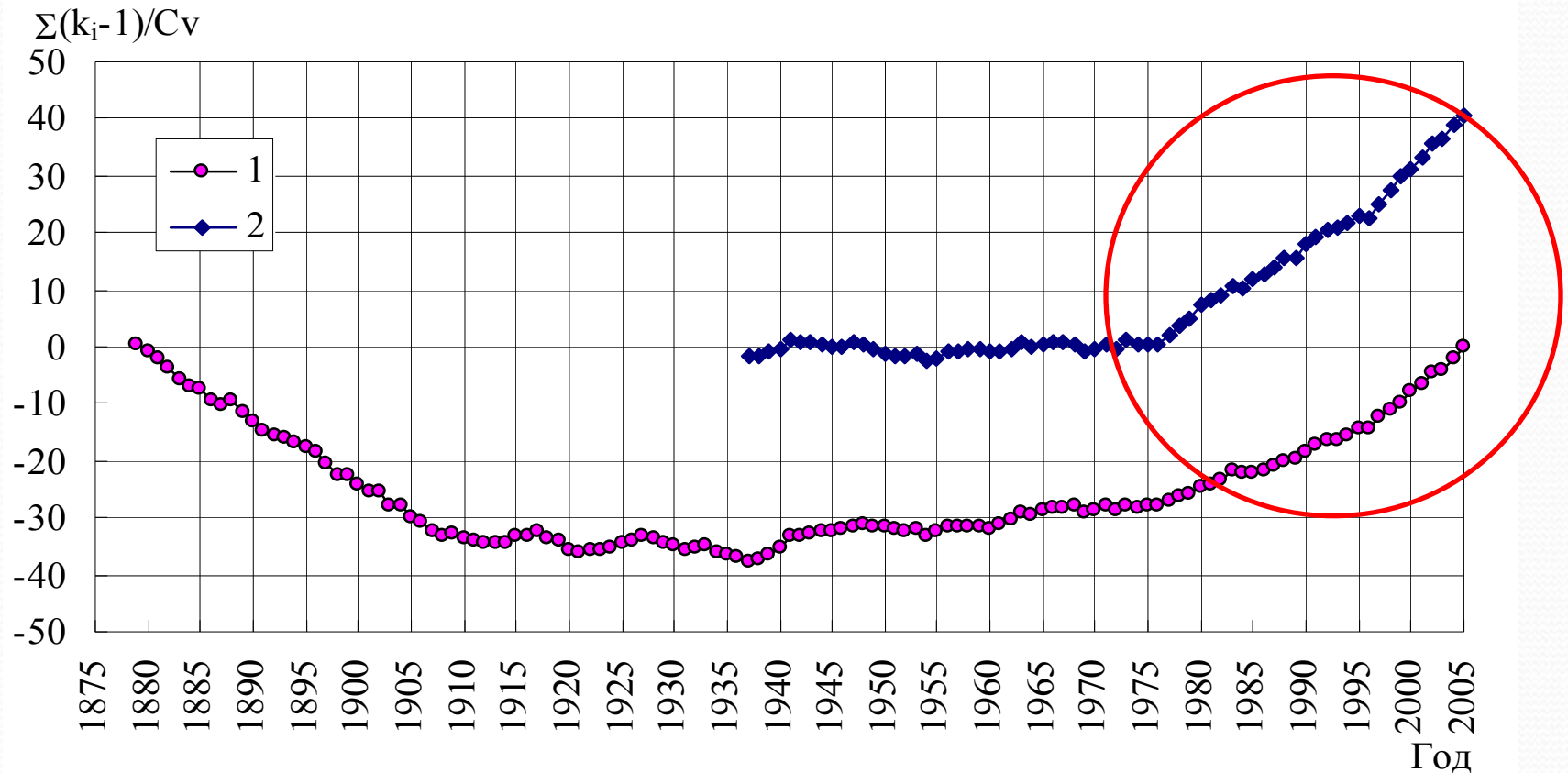
Area of mountains glaciations of Kazakhstan is decreasing.

Over a period of time 1956 – 2005 water-supply of the glaciations has decreased on 41-43 %.

As a result of it, at the beginning of the period glacial degradation, runoff increased, but later flowing of the rivers will be reduce.

Glaciologists predict, that glaciers of Kazakhstan may disappear at the end of 21-st century .

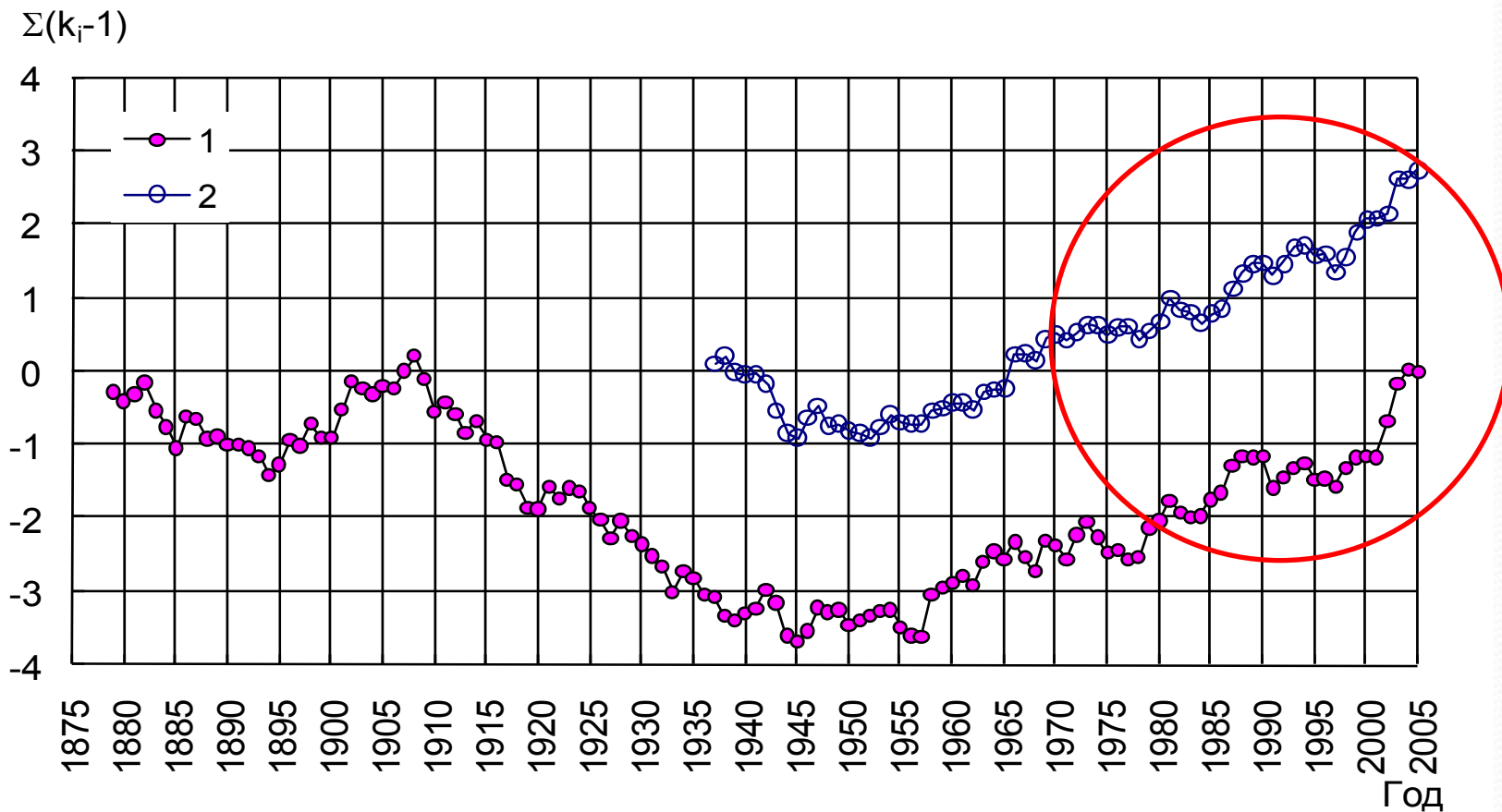
# Differential integral curve of the average air temperatures



1 – at Almaty HMS

2 – at Mynzhilky HMS

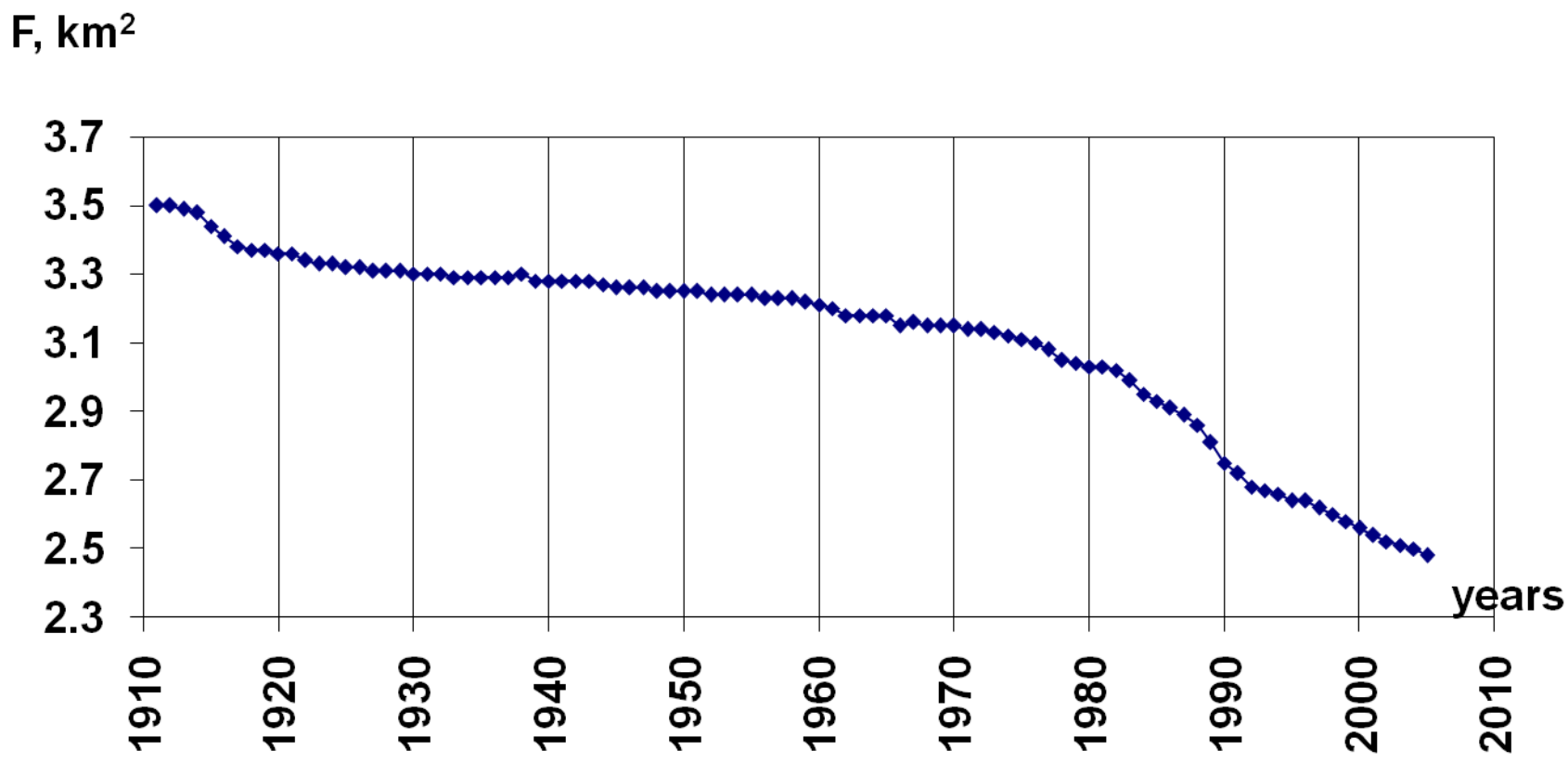
# Differential integral curve of the annual precipitation



1 – at Almaty HMS

2 – at Mynzhilky HMS

# Changing of the area of Ile Alatau glaciers (glacier Tuyuksu)

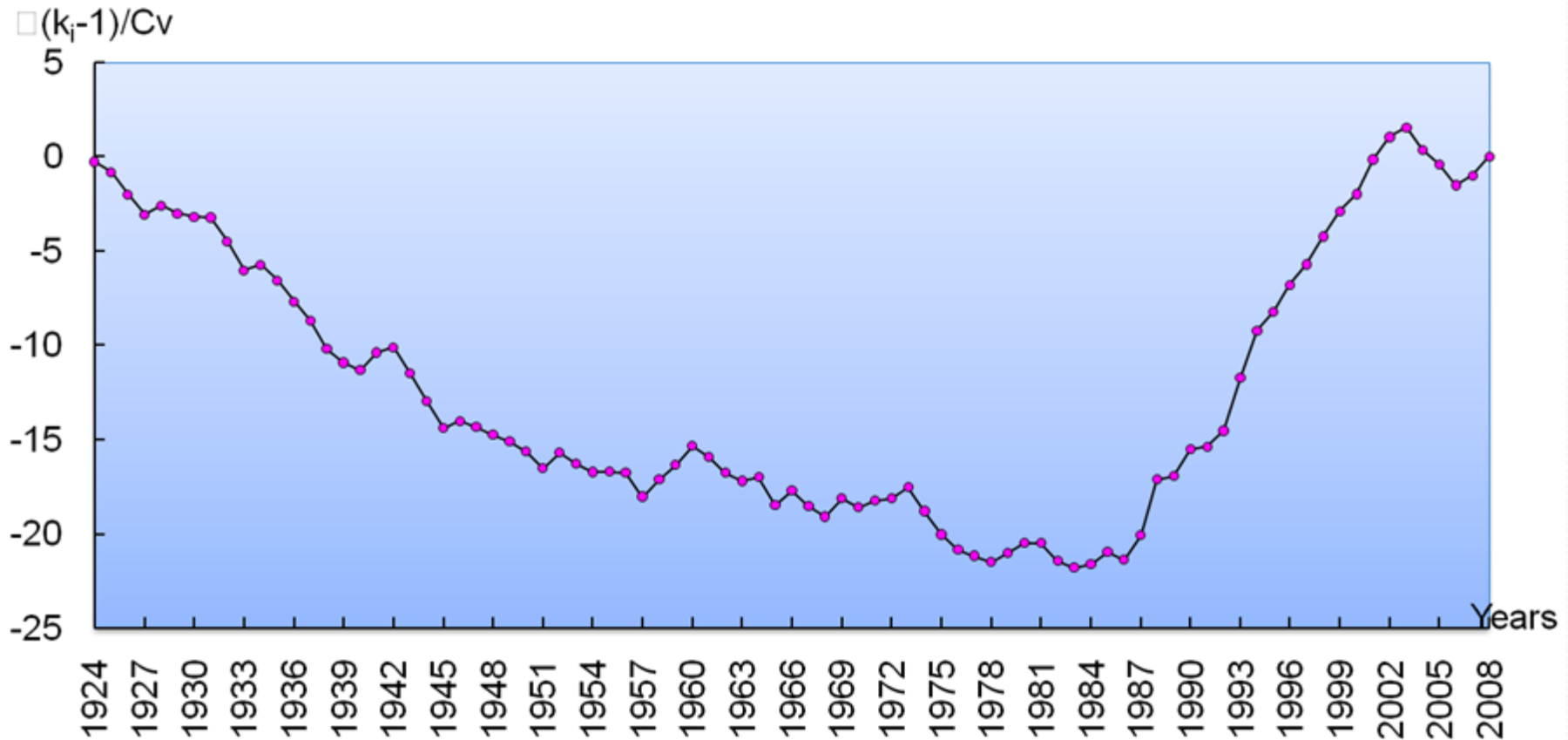


**Modern climate changes and rising temperatures on our planet has led to the degradation of glaciers in mountain river basins.**

# Glacier degradation in Balkhash Lake basin

Basin	Glacier area, km <sup>2</sup>				Glacier degradation	
	1955	1982	1990	2005	1955-2005	Year average
Lake Balkhash	4057,1	3219,4	2981,0	2558,7	<u>1498,4 km<sup>2</sup></u> 36,9%	<u>30,0 km<sup>2</sup></u> 0,74

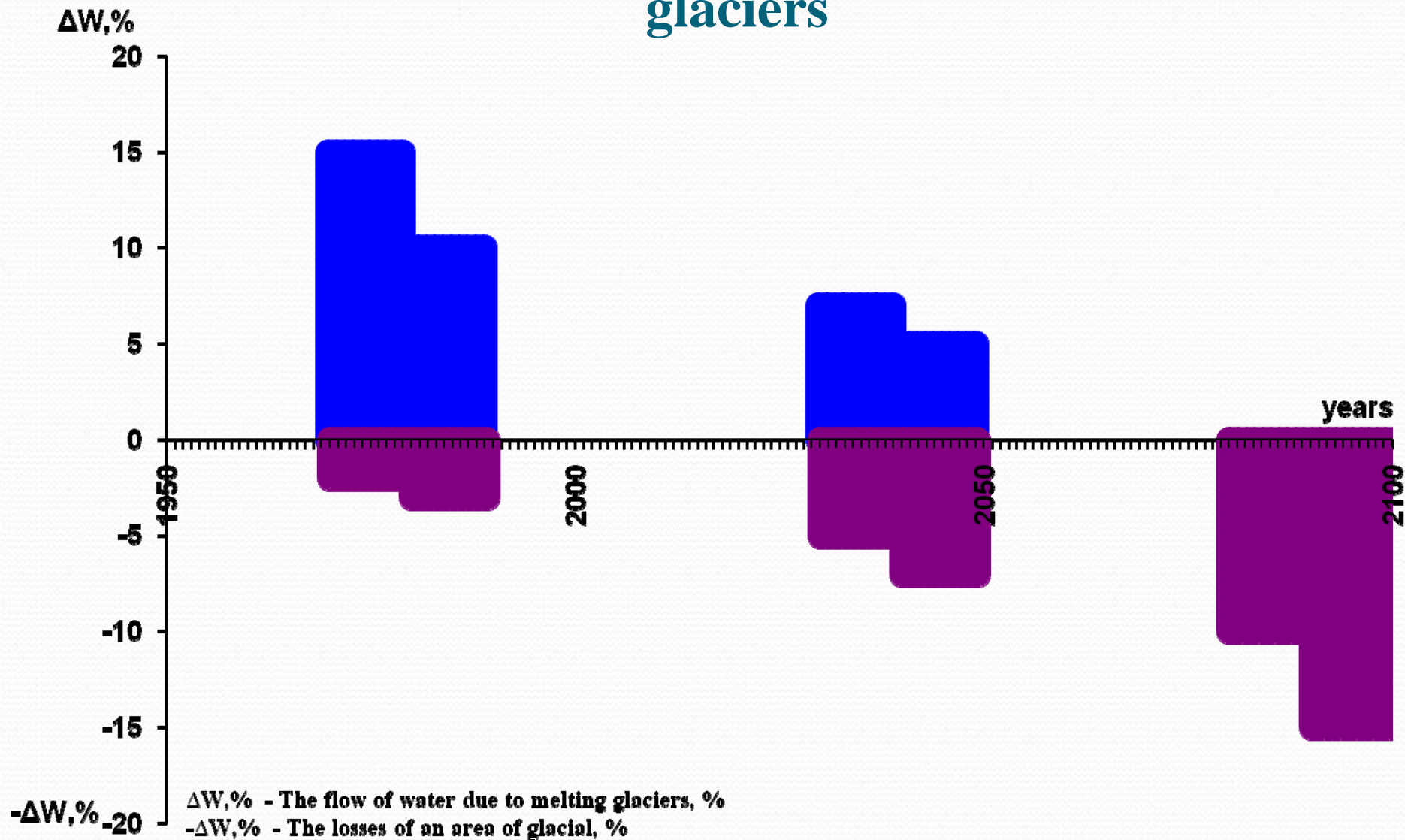
# Difference Integral Curve



Karatal River (begins from glaciers of Jongar Alatau mountains)

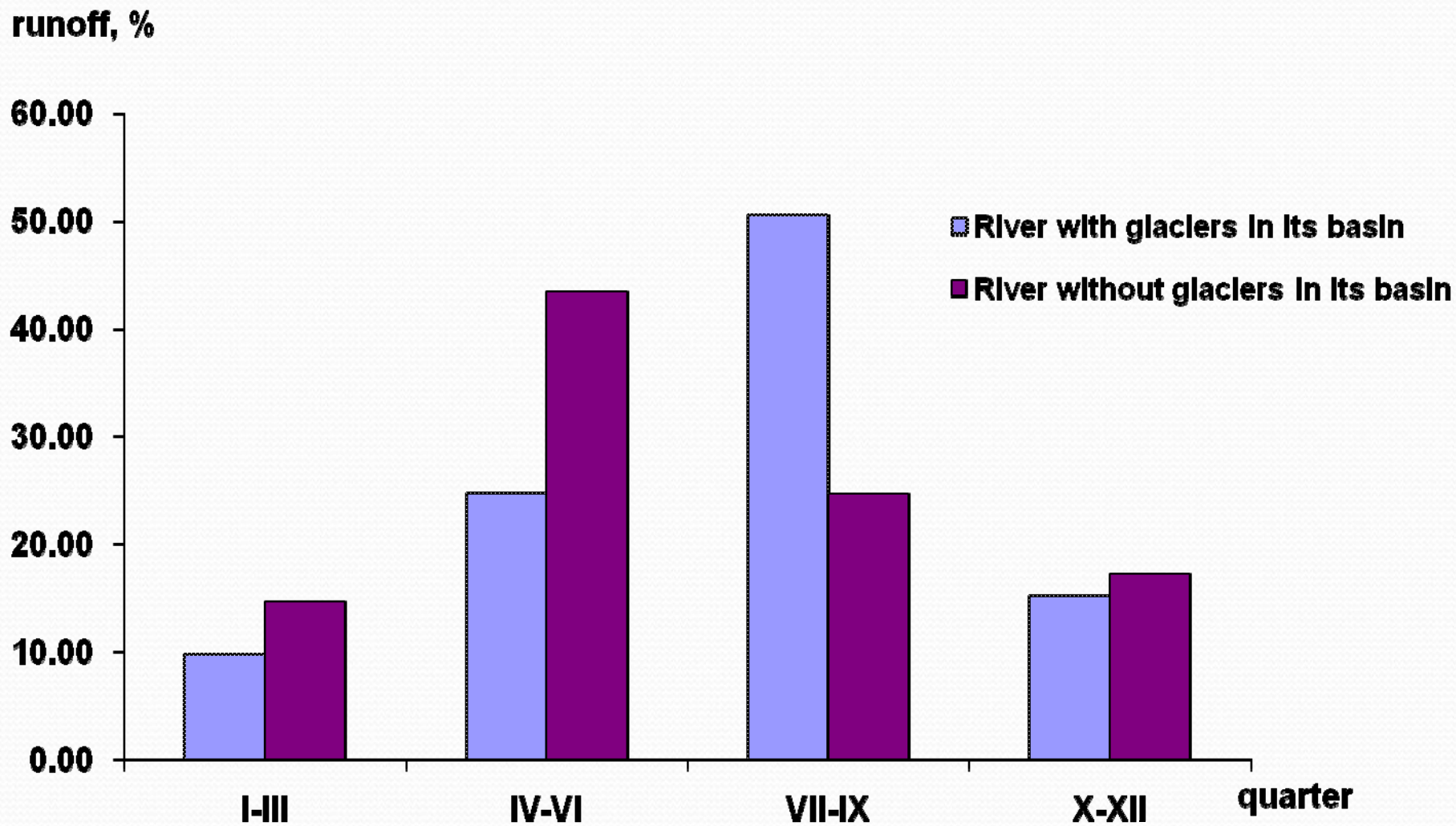
Starting from 1987 runoff has increased on 28 %

# Changing of surface water resources of Lake Balkhash (%) as a result of degradation of mountain glaciers





# Comparison of the quarterly average water flow of the rivers with glaciers in their basins and without it



# Decision:

- Reduction of surface water resources and changing the water regime of rivers under the influence of the degradation of mountain glaciers are a real threat to water supply to areas of irrigated agriculture.
- For adaptation to the negative changes in the environment we have to develop new methods of determining the water resources and the statistical characteristics of the river flow.
- The results of the determination of surface water resources and the statistical characteristics of the runoff in a changed climate conditions will be used for the building of necessary, new hydraulic structures.

# **Thank you for your attention!**



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