

*NEESPI-LCLUC-HE INTERNATIONAL
WORKSHOP*

*Mountain glaciers of the Tajikistan
in
condition of the Global Climate Change*

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8-15 September, Bishkek, Kyrgyzstan



No	Energetic object, HPS	Capacity, MW	Power output TWt·h x100	Area on Building Th. ha	Area of Wood Vege- on, Th. ha	Mig-on of Popul. Th.per s.	Index of efficiency			
							$\frac{MW}{ha}$	$\frac{TWt \cdot h}{ha}$	$\frac{MW}{ha}$	$\frac{TWt \cdot h}{ha}$
1	Togtogul	1200	41.0	31.9	-	29.3	0.038	0.128	-	-
2	Nurek	2700	112	21.5	0.200	1.50	0.126	0.522	13.50	56.00
3	Rogun	3600	133	17.0	6.800	16.0	0.212	0.782	0.529	1.956

$$K = \frac{\sum S_i}{S_{oi}} \times 100\%$$

K - coefficient reservoir influences on environment

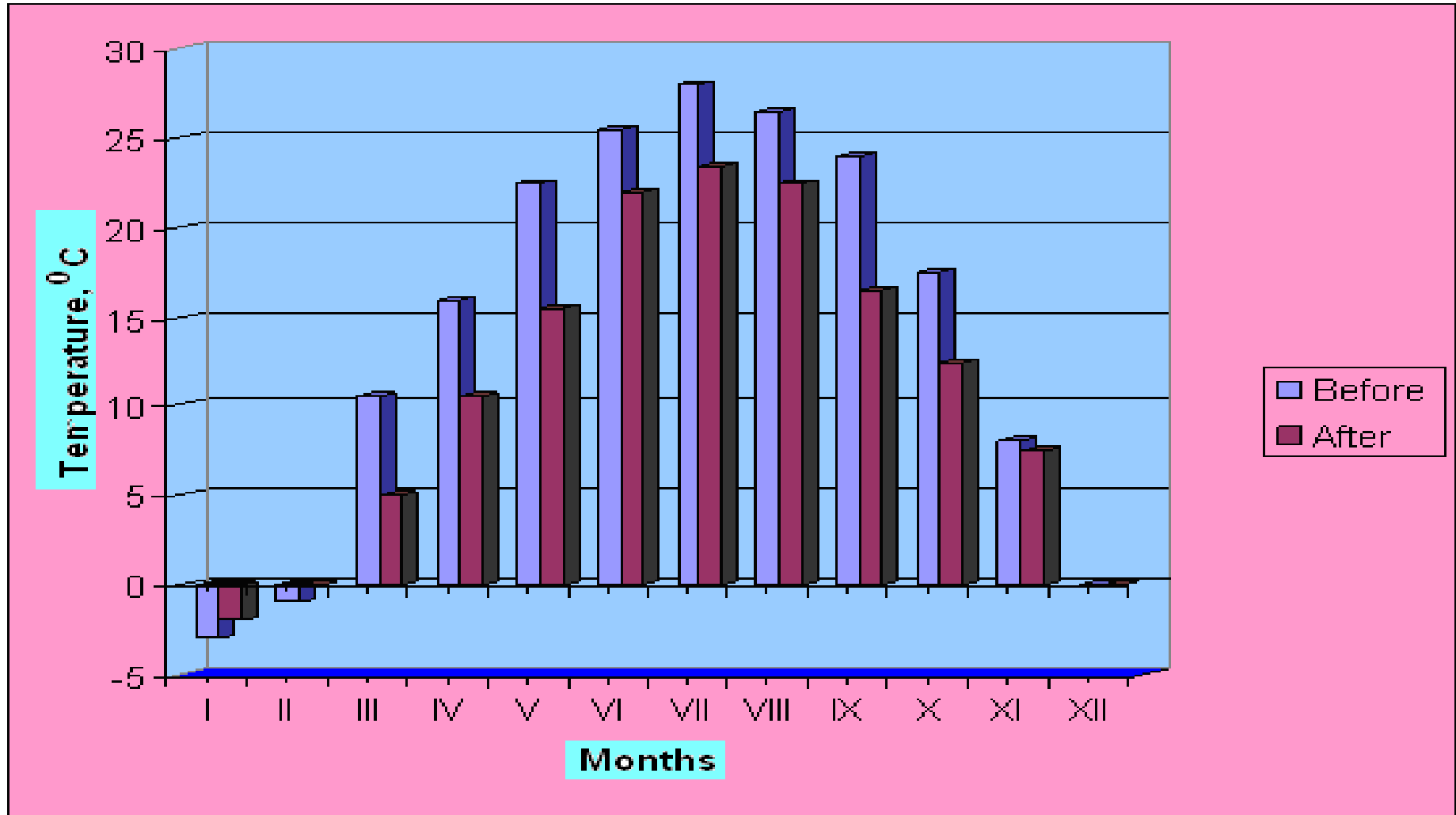
S_i - area of the territory under influences of reservoir, sq. km

S_{oi} - area of basin, sq. km

Average monthly temperatures of Vakhsh River water before and after building of the Nurek reservoir

River-Hydropost	Periods	Month						
		I	II	III	IV	V	VI	VII
Vakhsh Tutkaul	1946-1967	2.6	4.3	7.6	11.0	12.8	14.3	15.0
Vakhsh Sariguzar	1967-1971	2.0	4.0	8.1	11.5	13.2	14.4	15.0
Vakhsh Sariguzar	1972-1980	5.4	3.9	5.5	10.0	13.0	14.9	15.9
Difference		-3.4	0.1	2.6	1.5	0.2	-0.5	-0.9

Mid-monthly temperature before and after building of the Nurek HPS



The concept Central Asia (the former name is Middle Asia and Kazakhstan) that is used nowadays includes the republics of CIS: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Afghanistan. Hydrographically the Central Asia Region (CAR) is distinguished as the Aral Sea basin, which in its turn consists of two basins – the Syrdarya and the Amudarya Rivers.



Surface water resources of the Aral Sea basin

Country	The Amudarya River basin, km ³ /year	The Syrdarya River basin, km ³ /year	The Aral Sea basin	
			km ³ /year	%
Kazakhstan	—	4,50	4,50	3,9
Kyrgyzstan	1,90	27,4	29,30	25,3
Tajikistan	62,9	1,1	64,00	55,4
Turkmenistan	2,78	—	2,78	2,4
Uzbekistan	4,70	4,14	8,84	7,6
Afghanistan	6,18	—	6,18	5,4
CA	78,46	37,14	115,6	100,0

Principal spheres used of water resources in Central Asia

Irrigation

Hydroelectric engineering

1990

Total area
irrigated lands



8.8 mln. ha

Total capacity of all
electric power station



37.8 mln. kWt

Unfortunately all these impressive results led to the same great negative consequences. Intensity of processes of ecological equilibrium violation in the region, which especially became apparent in the Aral Sea zone

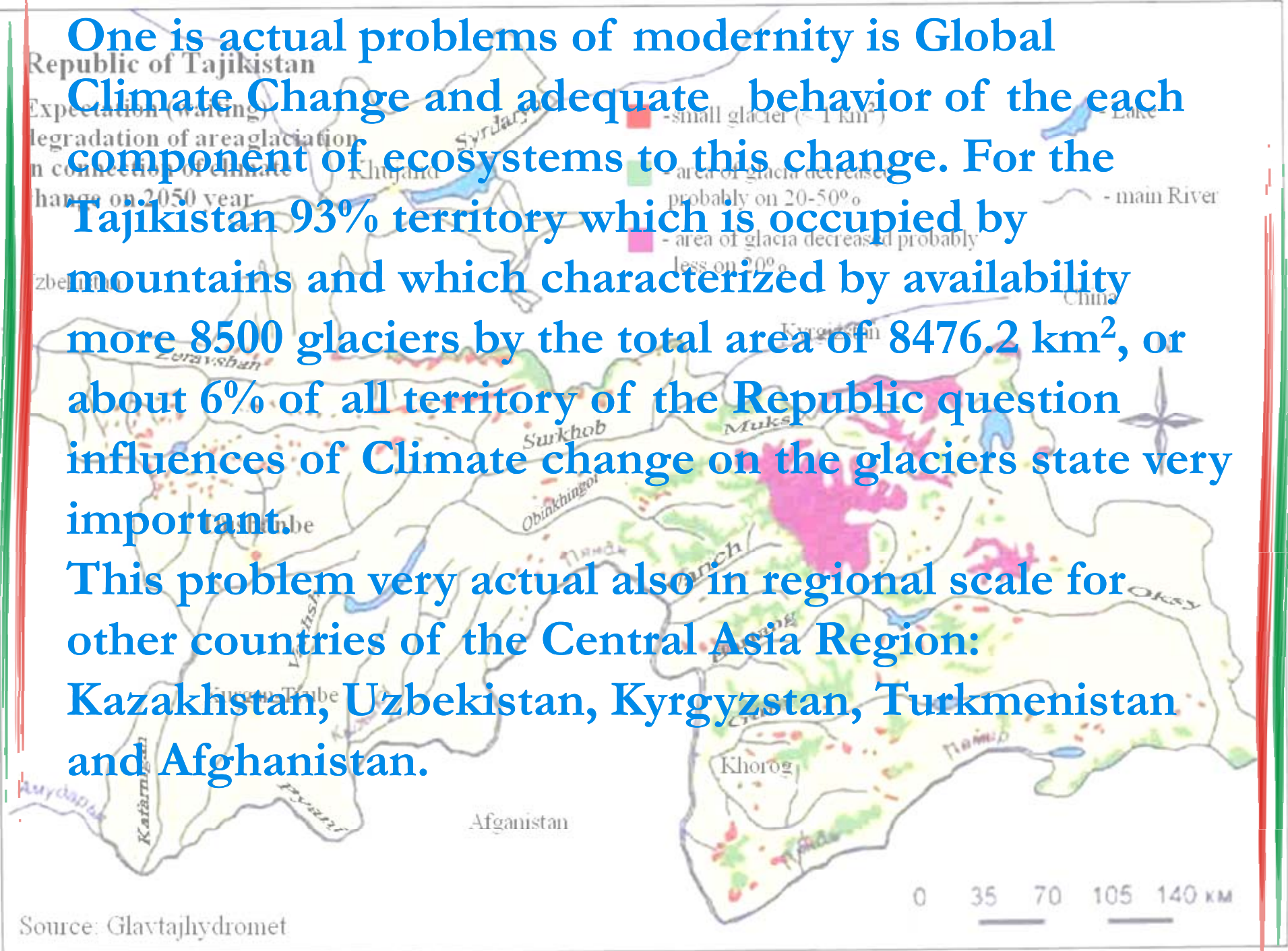


- ☀ intensity of processes of the ecological equilibrium
- ☀ desertification
- ☀ salinization
- ☀ water quality



Ecological disaster of the Aral Sea zone

One of the actual problems of modernity is Global Climate Change and adequate behavior of the each component of ecosystems to this change. For the Republic of Tajikistan 93% territory which is occupied by mountains and which is characterized by availability of more 8500 glaciers by the total area of 8476.2 km², or about 6% of all territory of the Republic. The influences of Climate change on the glaciers state very important. This problem very actual also in regional scale for other countries of the Central Asia Region: Kazakhstan, Uzbekistan, Kyrgyzstan, Turkmenistan and Afghanistan.



Climate

Relief and climate are two main factors determining formation of natural environments and water resources of Tajikistan

One of basic characteristics of change of a climate
the temperature and precipitations are influences
on formation of snow and ice reserves

The data analysis of air temperature and
precipitations demonstrates, that the climate of
Tajikistan is subject of influence of global changes,
but also has the own features

Glaciations

One of the main natural potentials of Tajikistan is the presence of large resources of sweet water. A great number of glaciers and snow banks serve as natural accumulators of this water. The melt waters of glaciers and never fields make 25 % of a volume of the rivers flow of Tajikistan

Gissar Mountains

Glacier of Gissar mountains - Yakarcha locate in high Maykhura rivers, the right making Varzob river which are flowing down from a southern slope of Gissar mountains.

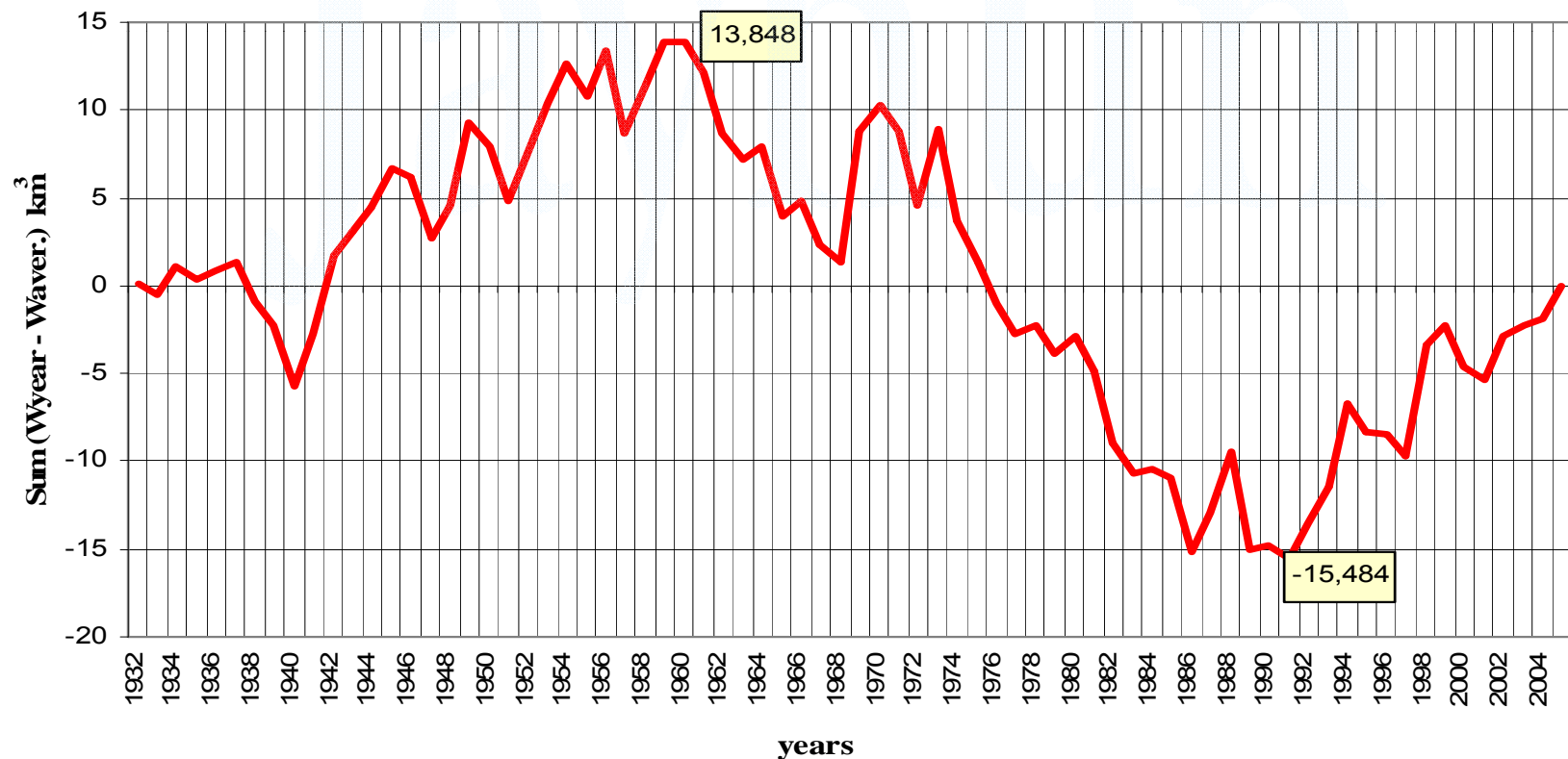
Yakarcha glacier is northeast exposition in length of 1.5 km and the area 0.9 km². Height of the tongue is 3800 m, firn lines - 3940 m, the maximum part of glacier - 4160 m; volume of a glacier 23 mln.m³.

As appeared, for 18 years (the previous shooting was in 1988) the glacier Yakarcha has not changed almost. Global warming was not reflected almost in it

Glacier HGP (received the name in honour of the Hydrographic party) lies on northern slope of Gissar mountains in the river basin of Saritag (Iskaderkul lake). The length of a glacier of ***1.16 km***, average width of ***0.47 km***, the area ***0.54 km²***, begins it at height of ***3820 m***, comes to an end at height of ***3520 m*** above sea level

4- *12, August, 2006* the second expedition surveyed glaciers in Zerafshan Karatag basin. For last 16 years (1990 - 2006 years) a glacier has receded on *35-55 m* annually the average its speed has made about *3 m* per year though in the eightieth years of the last century it has made about *8 m* annually. Shooting of a cross-section structure has shown that the glacier has not changed almost, and recedes only from a final part

character of variability of a drain of the river Vakhsh for the period 1932-2004 which demonstrated that at very big variability of an obvious trend of volume of a drain of the river Vakhsh it is not observed. Within 75 years of supervision change of volume has made a full cycle and has returned to an initial point. Moreover, the possible changes of a river drain connected with change of a climate as show direct supervision, are shown in the form of the phenomena favorable economic activities. The researches lead to Tajikistan, including calculations on special mathematical models have shown, that an end result of change of a climate the order with change of volumes of a drain will be increase in quantity of atmospheric precipitation.



The main area of glaciations is in mountains of North-West Pamir the center of which is Fedchenko glacier - the largest mountain glacier in the world

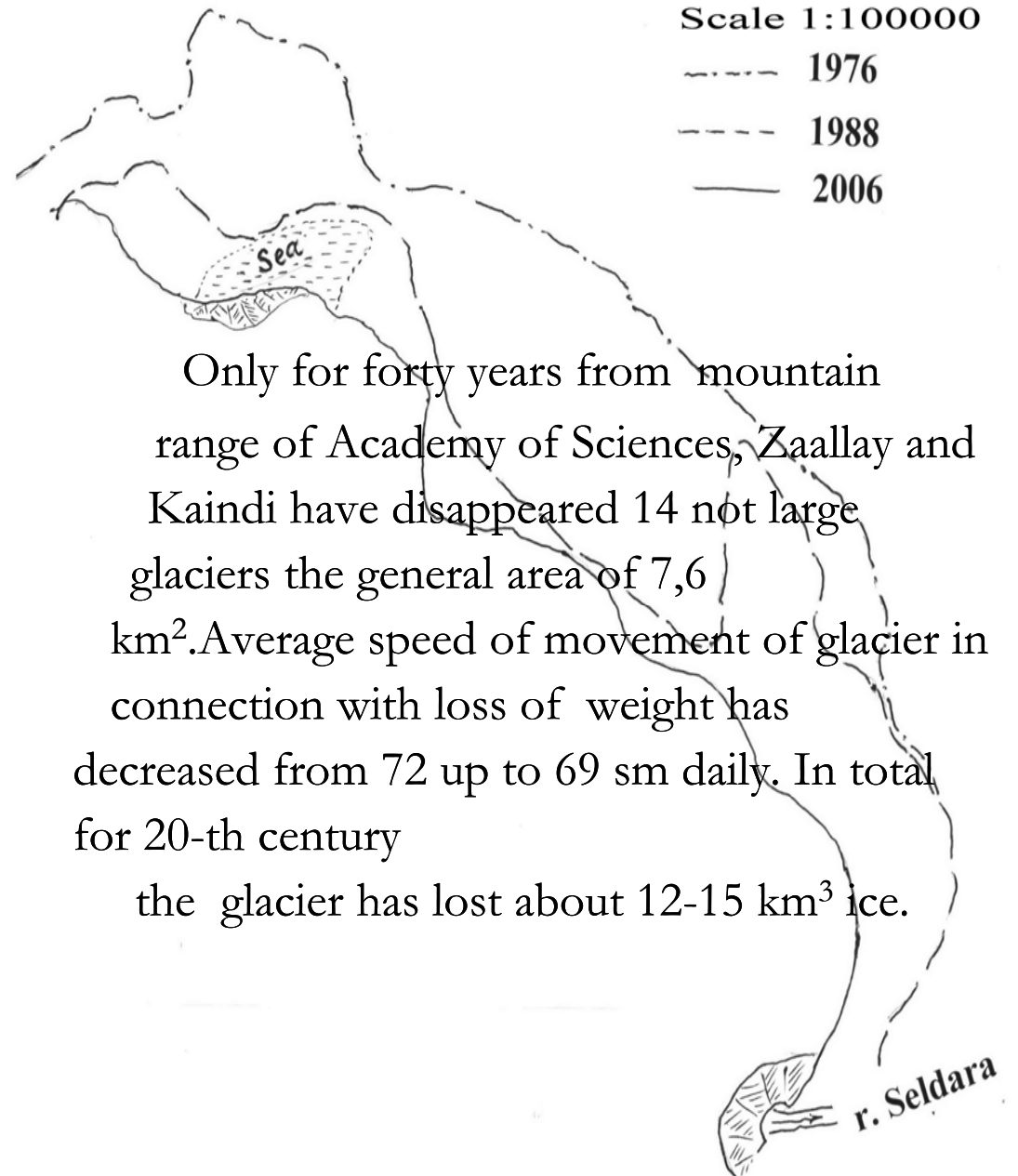
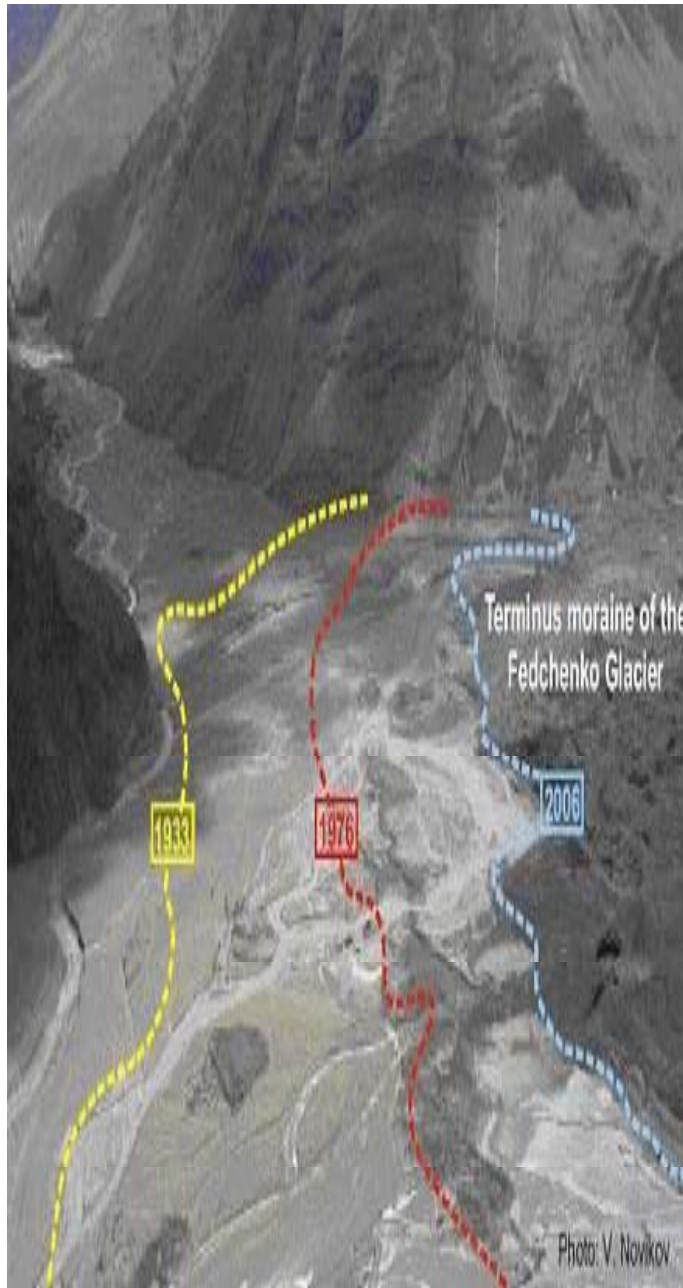
Characteristics of Fedchenko glacier

Length	77 km
Average width	2,5 km
Maximal width	5 km
Area with all tributaries	~ 652 km ²
Ice thickness	~1 km

By 1988 the Fedchenko glacier step back more than on 500 m and has decreased on the area 4 km². Average speed of step back of the Fedchenko glacier for the XX century made 10-12 meters per year. Its bottom part for the space of nine kilometers subsides; it was broken with numerous cracks.

Deviation of Fedchenko glacier

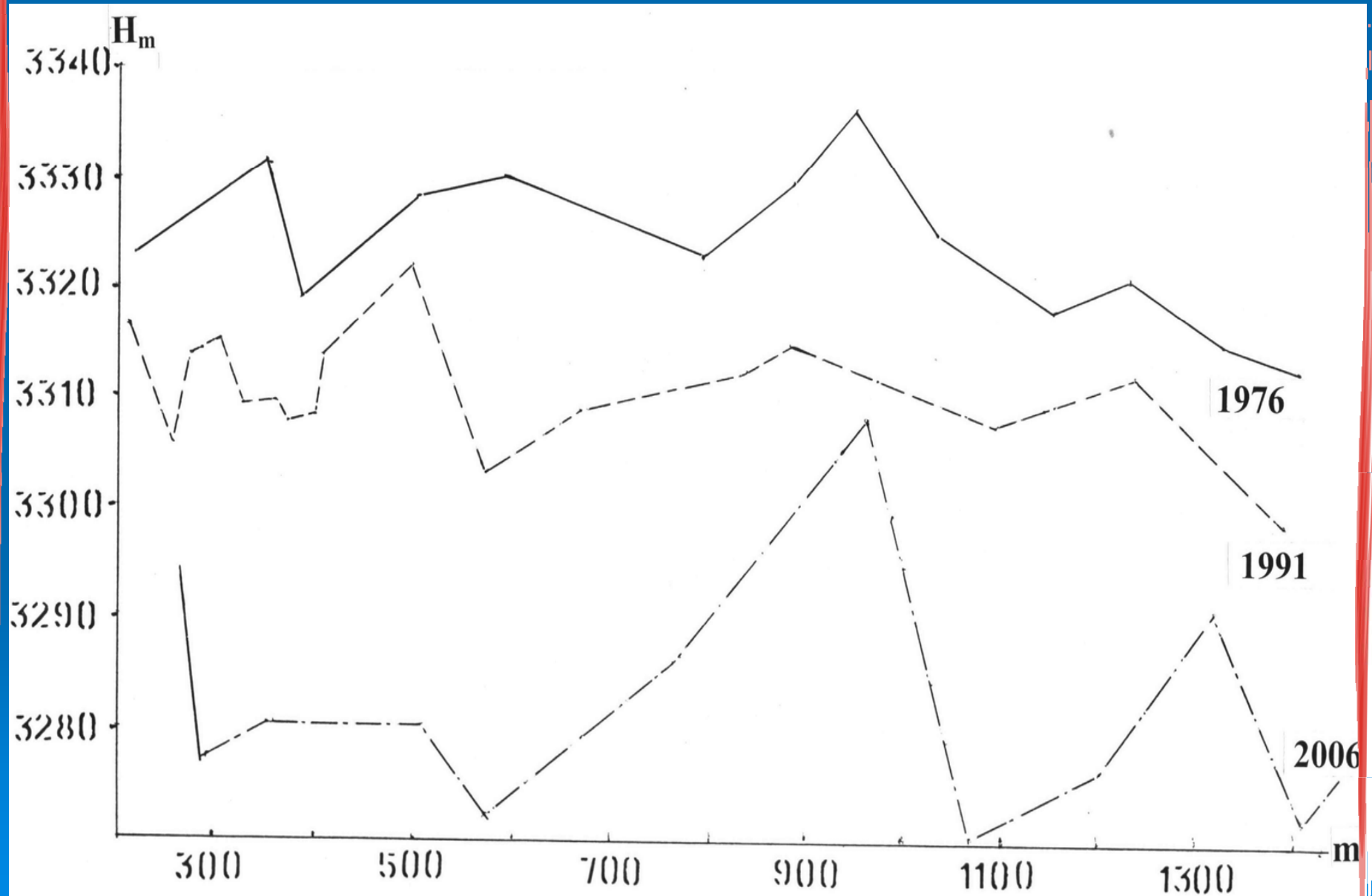
⊙ Rp6



Only for forty years from mountain range of Academy of Sciences, Zaally and Kaindi have disappeared 14 not large glaciers the general area of 7,6 km². Average speed of movement of glacier in connection with loss of weight has decreased from 72 up to 69 sm daily. In total for 20-th century the glacier has lost about 12-15 km³ ice.

The next expedition on glacier Fedchenko has been organized in September, 2006 after an eighteen-year break. It was observed, that glacier Fedchenko continues to be reduced non-uniformly with speed of 8-10 meters per year. In the eightieth years of the twentieth century the glacier reduced on twenty meters per year. On a cross-section structure in seven kilometers the glacier is higher than tongue settles 1,5 meters annually though twenty years ago intensity of subsidence made 2,0 - 2,5 meters per year

Cross section change of the profile No.4 Fedchenko glaciers



East Pamir

The degradation of the glaciers on East Pamir in connection with cold climate occurs less intensively than in other mountain areas of the country. The observation of 2005 year have shown that tongue of the Akbaytal glacier since 1986 has receded on 15 m and its right board on 40 meters. Average intensity of deviation makes 1-2 m per year. In area of the Sarez Lake five small glaciers have completely disappeared. In total for second half of last century glaciers of Murgab river basin have thawing almost on 30-40%.

In the basin of the Obikhingoy river glacier Garmo is one of basic glaciers which is strong moraines and continues to thaw intensively, breaking up on separate blocks. For the period 1932-2007 years the glacier Garmo has receded on 7 km, that is the most significant reduction



Source: Tajik Agency on Hydrometeorology

Degradation of the Garmo Glacier.

- In 2000 Desinov and Konovalov(2007) by decoding of images from satellite Landsat ETM+ it has been certain the area of the Muksu River basin a glaciation and by comparison of these results with data of the Shetnikov (1997) it has done following conclusions:
- during all interval of long-term supervision steady reduction of a total area of a glaciation in the Muksu river basin is marked. Average rate of degradation of the sizes of glaciers per 1980-2000 has increased in comparison with the previous interval of time;

Thank You
For Your Attention