GEOSS Symposium on Integrated Observation for Sustainable Development in the Asia-Pacific Region
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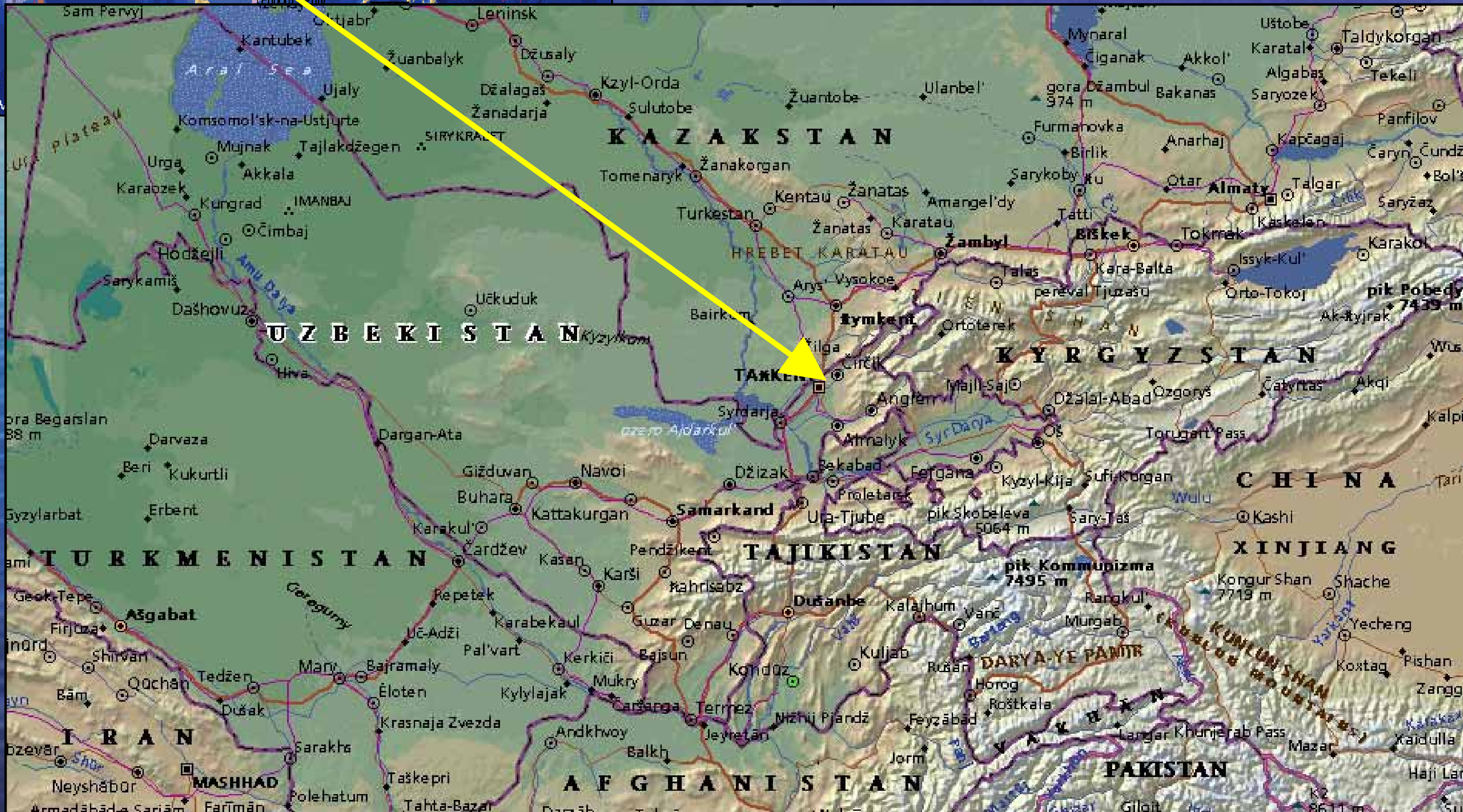
"What is happening in the water cycle and water resources management under possible (ongoing) impacts of the climate change?"

Dr. Sergey MYAGKOV
NIGMI of Uzhydromet
72, K.Makhsumov street,
Tashkent, 100052,
Uzbekistan
E-mail: nigmi@albatros.uz

Republic of Uzbekistan



The evaluation of the annual air temperature (*ΔT°, C*) of the climatic regions of Uzbekistan according to realization of different scenarios of greenhouse gases emission

Climatic region	Base period standard	Regional climatic scenario II for 2015-2030			Regional climatic scenario I for 2020-2050		
		A,b	C,d	E,f	A,b	C,d	E,f
Tashkent	14.2	2.0	1.0	1.5	2.0	1.4	3.0
Western Tien Shan	5.2	1.0	0.5	1.0	0.5	0.3	0.5
1000-1500 m above sea level	9.5	1.0	0.5	1.0	0.5	0.4	0.7
1600-2100 m above sea level	2.8	1.0	0.5	1.0	0.5	0.6	1.1

The deviations of check model values of air temperature (°C) from the base standards on the plain territory of Uzbekistan during 1951-1980

Model	Winter	Spring	Summer	Autumn	Year
CCC	-9.9	-6.6	0.5	-4.3	-5.1
UKMO	-3.5	-2.1	1.1	0.4	-1.0
GFDL	-9.5	-1.1	1.1	-2.0	-2.9
GISS	0.3	-2.8	-1.5	-0.9	-1.2

CCCM *is a Canadian Climate Center model, space resolution: Latitude 2.5° and Longitude 3.75°, CO2 moistening sensitivity: 3.5°C;*

UKMO *is a United Kingdom Meteorological Office model, space resolution: Latitude 2.5° and Longitude 3.75°, CO2 moistening sensitivity: 3.5°C;*

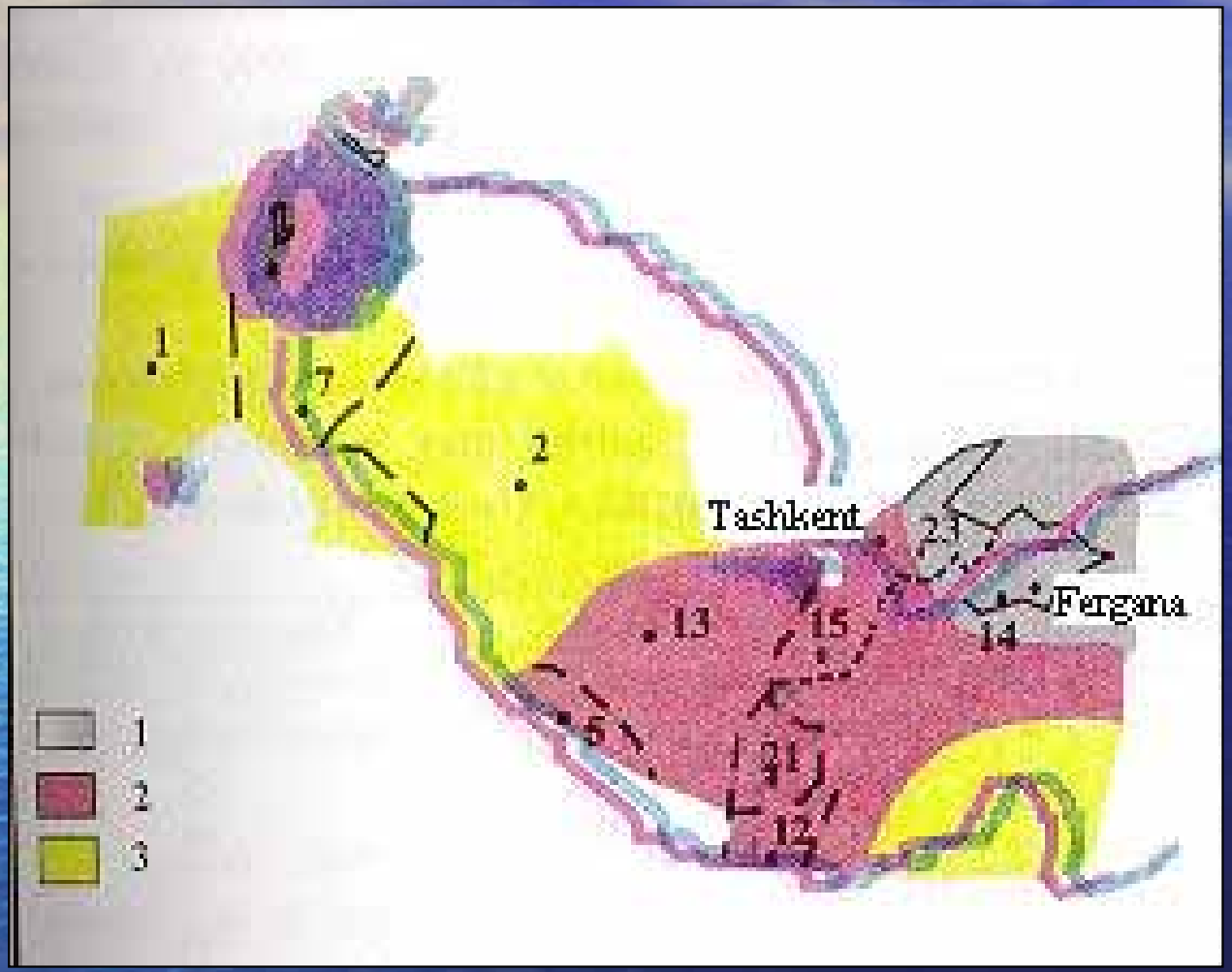
GFDL *is a US Geophysical Fluid Dynamics Laboratory model, space resolution: Latitude 2.22° and Longitude 3.75°, CO2 moistening sensitivity: 4°C;*

GISS *is a US Goddard Institute for Space Sciences model, space resolution: Latitude 7.83° and Longitude 10.00°, CO2 moistening sensitivity: 4.2°C.*

The model scenarios of possible changes of temperature (dT, °C) and precipitation (R, %) in the deviations from the base standards on the plain and mountain territory

Territory	Winter		Spring		Summer		Autumn		Year	
	dT, °C	R, %	dT, °C	R, %	dT, °C	R, %	dT, °C	R, %	dT, °C	R, %
CCC										
Plain	8.9	108	8.0	8.8	6.0	75	4.6	133	6.9	100
Mountains	6.7	98	7.7	9.3	6.5	57	5.2	104	6.5	89
UKMO										
Plain	6.1	100	5.8	65	6.6	150	5.5	67	6.0	90
Mountains	4.3	117	5.2	93	6.4	128	5.1	103	5.2	106
GFDL										
Plain	3.2	100	5.1	76	5.1	200	4.3	133	4.4	110
Mountains	3.1	122	3.1	105	3.7	140	3.7	129	3.4	114
GISS										
Plain	5.1	131	3.5	141	4.5	192	4.2	83	4.6	140
Mountains	5.3	128	4.0	117	4.7	108	4.8	91	4.7	113

Change (%) of the annual precipitation totals by 2030 in Uzbekistan and the adjoining mountain territory in comparison with 1961-1990.



For emission scenarios **cd**:
1 – 100-105%
2 – 105-110%
3 – 110-115%

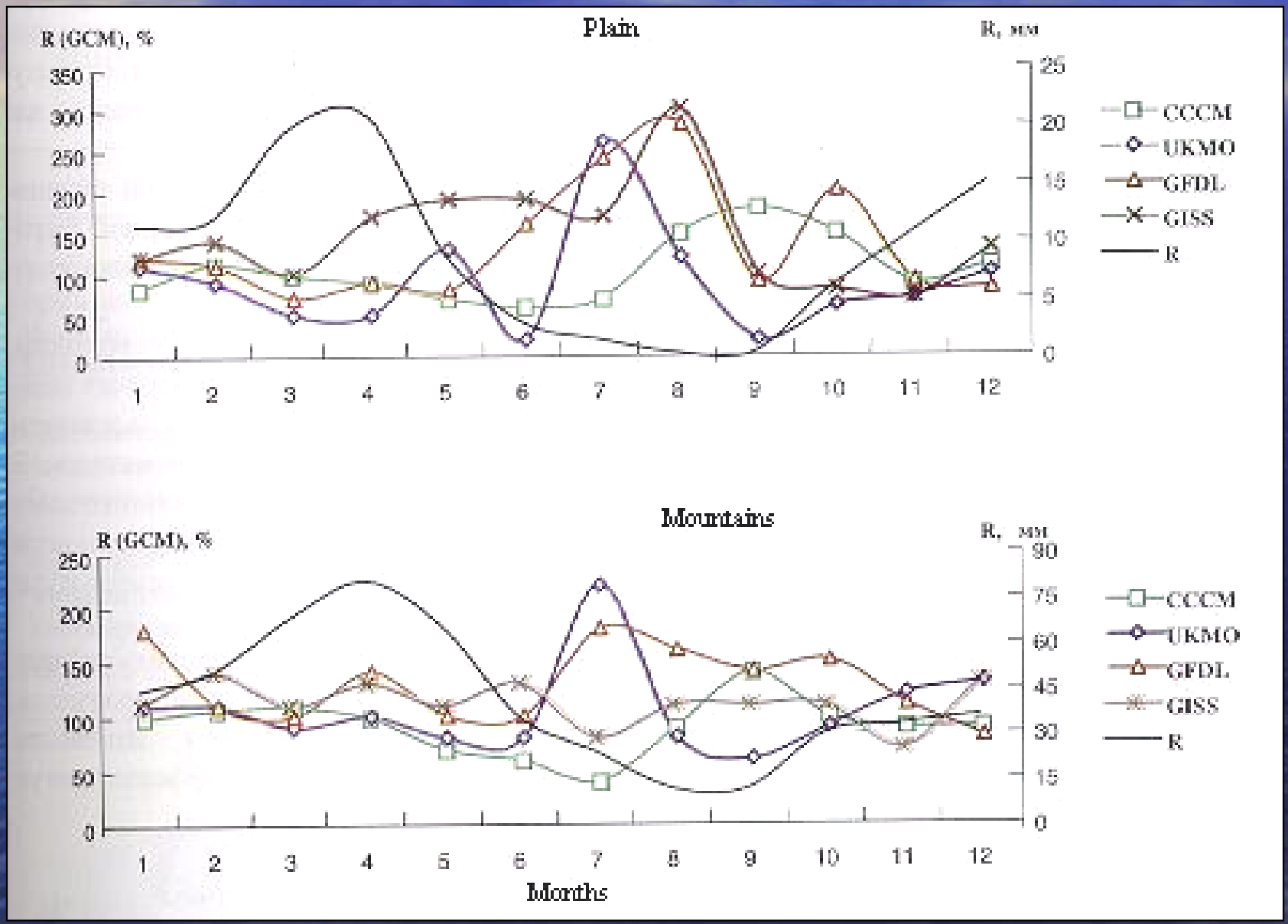
For emission scenarios **ab**:
1 – 105-110%
2 – 110-115%
3 – 115-120%

For emission scenarios **ef**:
1 – 110-115%
2 – 115-120%
3 – 120-125%

Model scenarios of possible changes of seasonal and annual amount of precipitation (% of the base standard of 1951-1980) in Uzbekistan and the adjoining mountain territory by the time of CO2 concentration doubling in the atmosphere

Area	Winter	Spring	Summer	Autumn	Average annual
CCC					
Plain	108	88	75	133	100
Foothills	97	93	50	106	95
Mountains	98	93	57	104	89
UKMO					
Plain	100	65	150	67	90
Foothills	108	70	100	100	92
Mountains	117	93	128	103	106
GFDL					
Plain	100	76	200	133	110
Foothills	124	71	150	121	116
Mountains	122	105	140	129	114
GISS					
Plain	131	141	192	83	140
Foothills	129	116	150	86	121
Mountains	128	117	108	91	113

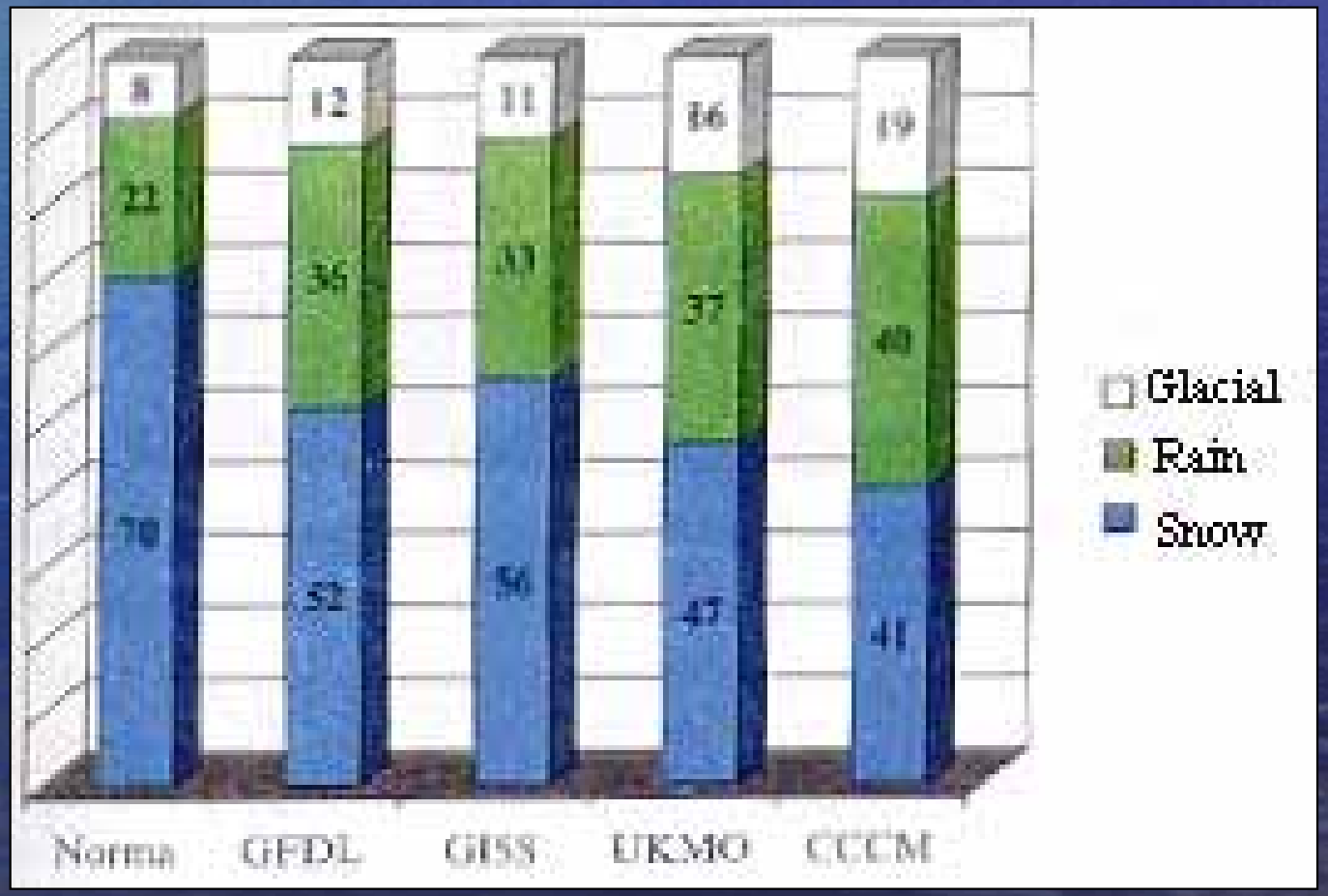
The expected precipitation changes (R) on the territory of Uzbekistan and the adjoining mountain area regarding the base standards of 1951-1980 and according to GCM.



The reaction of water resources of big rivers for the changes of climate will appear, first of all, in changes of correlation of the main source types, which will result in the change of hydrological regime.

If the contribution of a snow component in the flow of the Chirchik river is evaluated as 60-75% at present time, then, according to model designs, its value will be decreased by 15-30% when realizing different scenarios of climate change

Correlation (%) of snow, rain and glacial components in the total annual water entry of the Chirchik river (snow-rain source type of feeding) for the base period and at different climatic scenarios.



Glacial flow makes up 8-15% in the total annual flow of the rivers according to different evaluations. 20% increase is expected.

The increase of a rain component of flow form 12-15%, which is typical for the present time, up to 20-35% is expected.

While air temperature is raised, the most part of atmospheric precipitation will fall in the form of rains. Losses due to evaporation will be also increased.

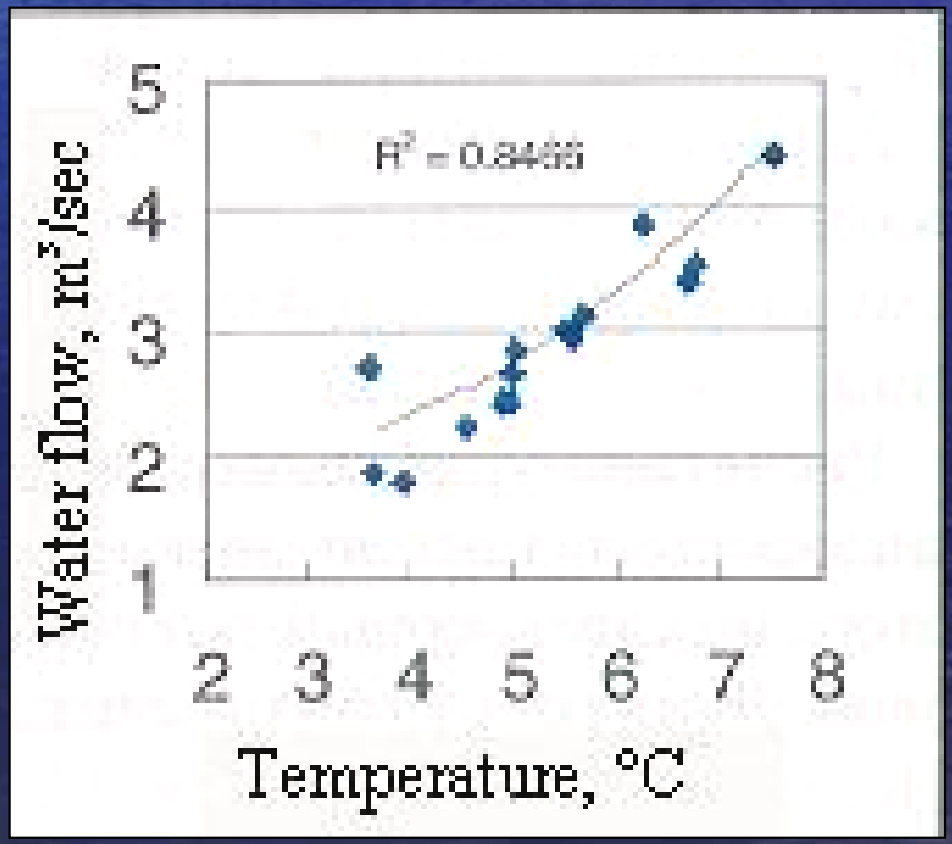
The winter snow accumulation will be decreased in the mountains. Reduction of glaciation will continue. These processes will negatively affect other hydrological parameters including those, which lead to the activation of abnormal processes: mud-and-stone flows, increase of risk of destruction of mountain lake dams, and other remote after-effects, which influence different characteristics of the regime of rivers.

The mathematical model of small mountain river flow generation, which had been developed by NIGMI, allowed evaluating the reaction of the flow of small water collections to the possible climate changes in different height and climatic zones of Uzbekistan according to the changes of meteorological parameters.

The range of reactions of small rivers to the climatic changes is rather wider. Differentiated analysis on the sources of feeding and regularity of flow generation of different altitude zones allows supposing that greater changes should be expected in the zone of mountains, which are close to glacier. These changes will be accompanied with the increase of glacial component of flow and with the decrease of glaciations.

The equality of volumes of snow and ice feeding is usually observed on the rivers, the glaciations of which makes up one third of the basin area. The flow of these basins will be increased at the expected warming according to the chosen gradations of precipitation change. In case of realization of scenarios, at which a little precipitation reduction will happen simultaneously with warming, the flow from the middle and low altitude zones will be decreased.

The correlation of annual flow from the basin on the average summer air temperature

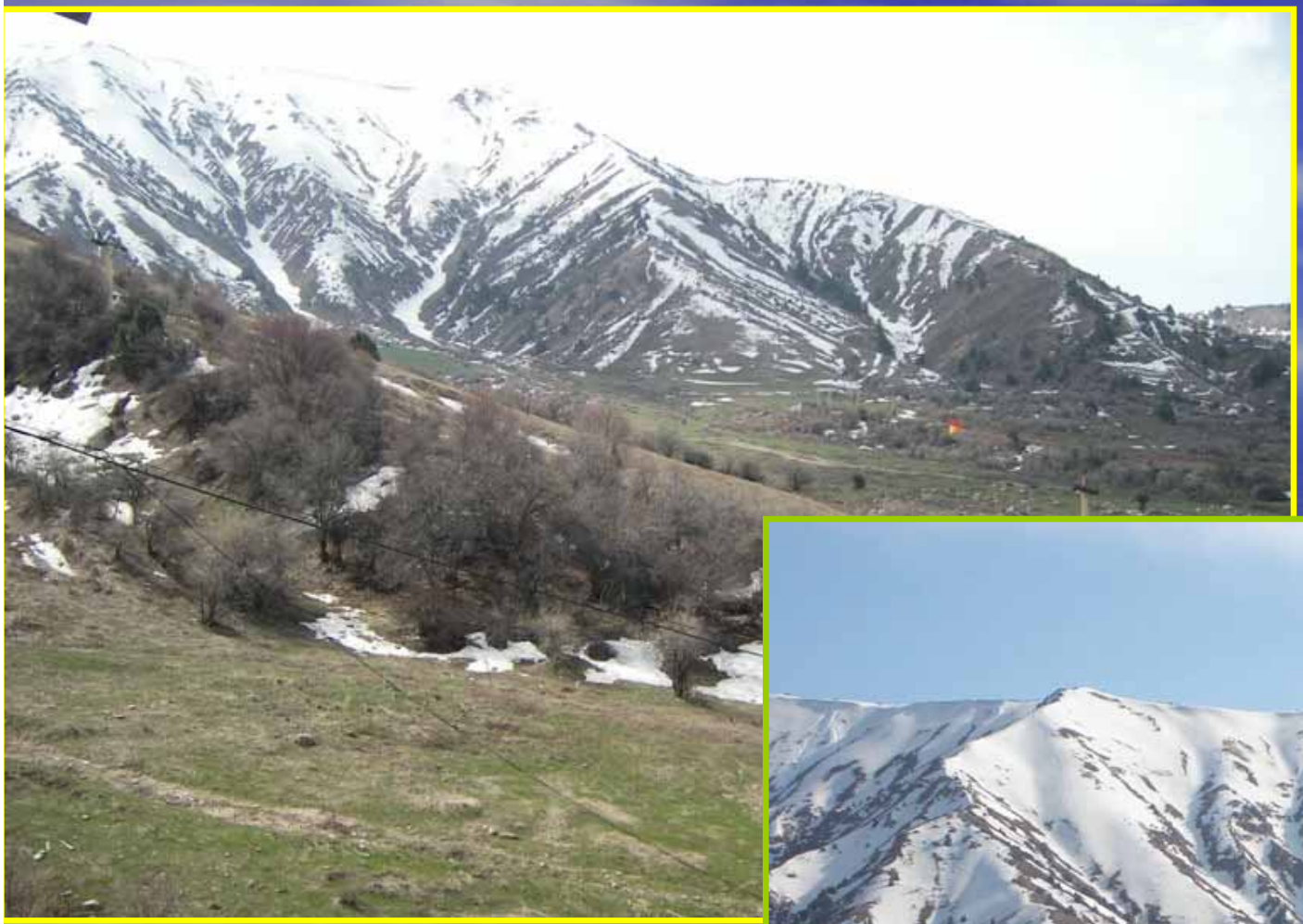


The following basic conclusions could be made:
At present, the unexpected reduction of Chirchik basin water resources has been observed;

The large valley glaciers are rather vulnerable to such unfavorable meteorological conditions like air temperature rise;

present-day weather conditions are extremely unfavorable for the existence of the glaciers. To maintain balance of glaciers it requires the decrease of improbable air temperature or increase of solid precipitation amount ;

reduction of glaciations in foreseeable future will occur the negative consequences, which concern the volume and the regime of flow, as well as the quality of fresh waters.

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