**United Nations/Austria/European Space Agency Symposium
on
Space Applications for Sustainable Development
To Support the Plan of Implementation of the
World Summit on Sustainable Development**

"Water for the World: Space Solutions for Water Management"

**13-16 September 2004
Austrian Academy of Sciences, Institute for Space Research
Schmiedlstraße 6, Graz, Austria**

Assessment of Dynamics of Lake Water Resources on Flat Territories and of Mountain Glaciers in Central Asia Using Digital Satellite Information
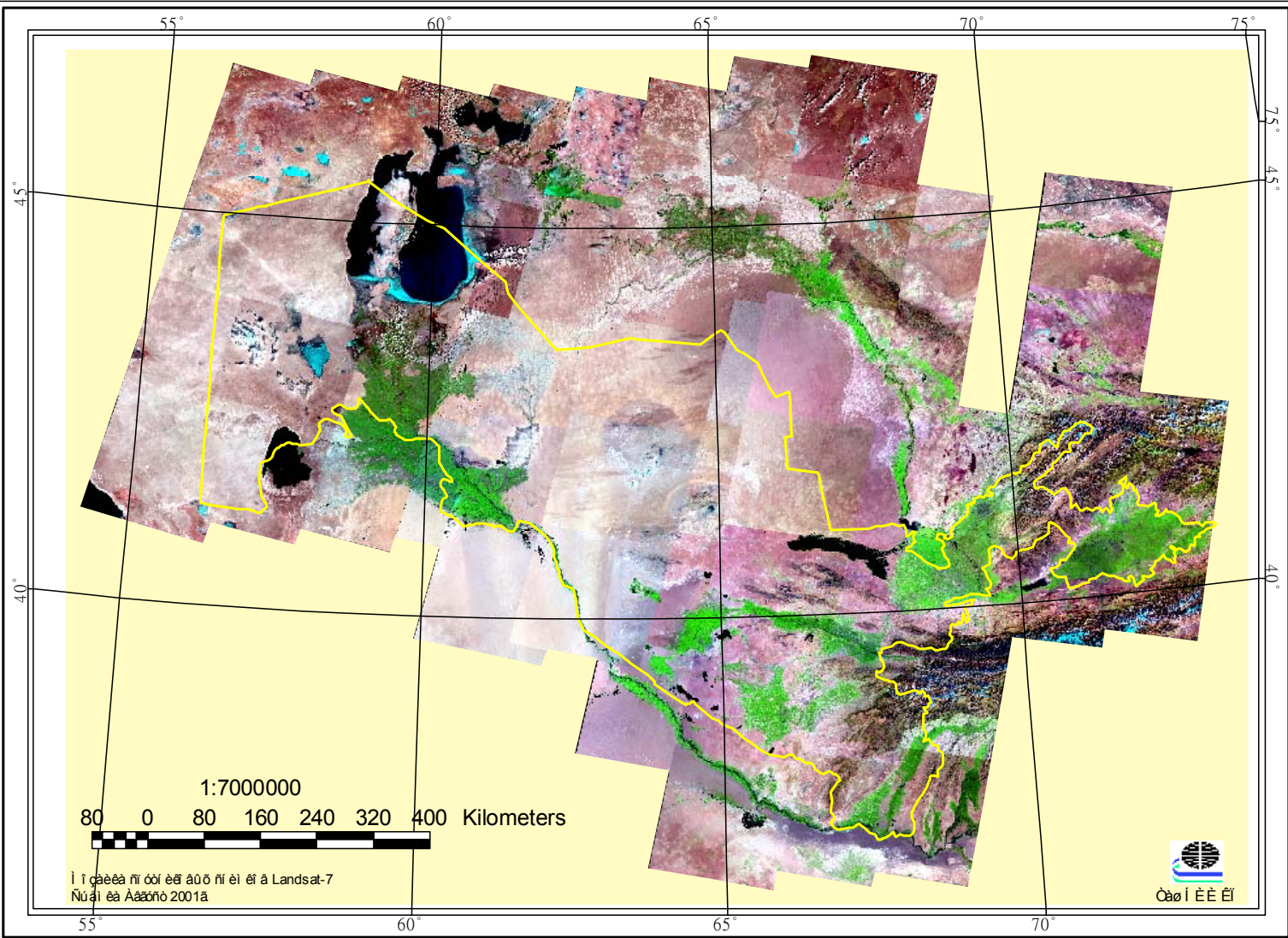
Water is the life

Aral Sea basin

Commonwealth of Independent States - Central Asian States

Water resources

- The large part of territory of region concerns to basin of the Aral Sea which water resources jointly are used by the Central Asian states.
- The basin of two great rivers - Amu-Darya and Syr-Darya are presented in average by 113.3 km3 per year
- Collected in two biggest basin of the Amu-Darya river (73.5 km3) and Syr-Darya river (38.8 km3).
- The area of ice (frozen area) in the basin of the rivers is 16.6 thousand km2.
- The amount of water in mountain lakes of Amu-Darya basin is 46.6 km3 and in lakes of Syr-Darya basin is 5.6 km3.The lakes are mainly located in the valleys of rivers.
- Within the area of Central Asia 98 water- reservoirs, which functioning now, were built. Their full capacity is 61 cubic kilometers and useful capacity is 44 cubic kilometers.

Allocation of rivers and lakes among the main regions of Central Asia

River basin, region/number of water bodies	Rivers		Lakes	
	Total	Length> 10 km	Total	Area > 1.0 km^2
Amu-Darya	40999	1787	2619	129
Syr-Darya	29790	1907	1405	65
Talas	3632	276	467	23
Chu	524	491	506	38
Sarydzhaz (Chinese Aksu)	4495	214	260	4
Issyk-Kul Lake	1976	134	183	20
S. Turkmenistan	2972	167	211	42
Total	**89018**	**4978**	**5961**	**321**

Allocation of fresh water resources between two largest rivers of Central Asia

| Water Resources (km³/year) of the Rivers in the Aral Sea Basin			
River	Average long-term volume of runoff	Volume of Runoff corresponding to 5% cumulative probability	Volume of Runoff corresponding to 95% cumulative probability
Amu Darya	73,5	108,4	46,9
Syr-Darya	38,8	54,1	21,4

Lakes and rivers of the region

There are presented:

- 89,000 rivers and
- 5,900 lakes

The water resources of the Central Asia are very limited

For the Central Asian region the drought means, first of all, the shortage of water resources
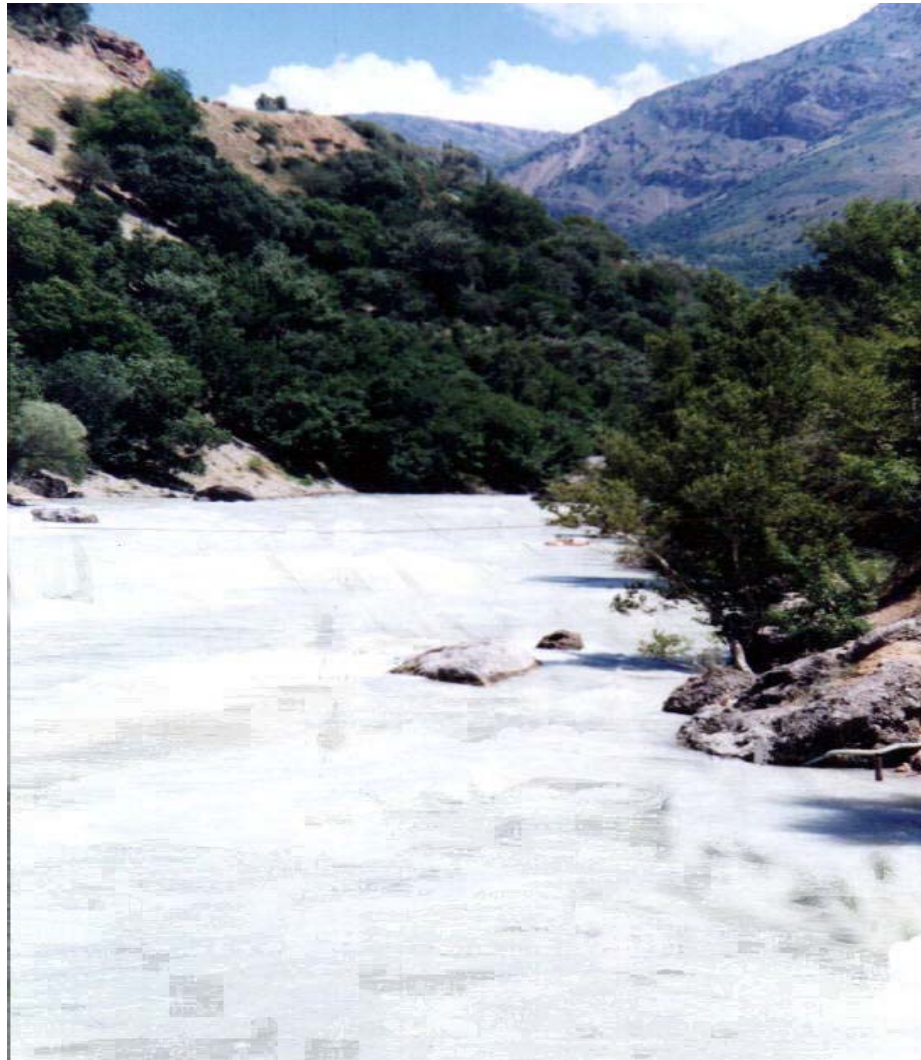
UNDER THE RECENT CONDITIONS OF WATER SHORTAGE IN CENTRAL ASIA, EVEN THIS SMALL BUT CONTINUOUS REDUCTION BECOMES A SERIOUS PROBLEM

Percentage of Aral Sea basin water resources formed in different countries

Uzbekistan 8%

Turkmenistan 0,03%

Kyrgyzstan 34%

Afghanistan 17%

Tajikistan 36%

Kazakhstan 5%
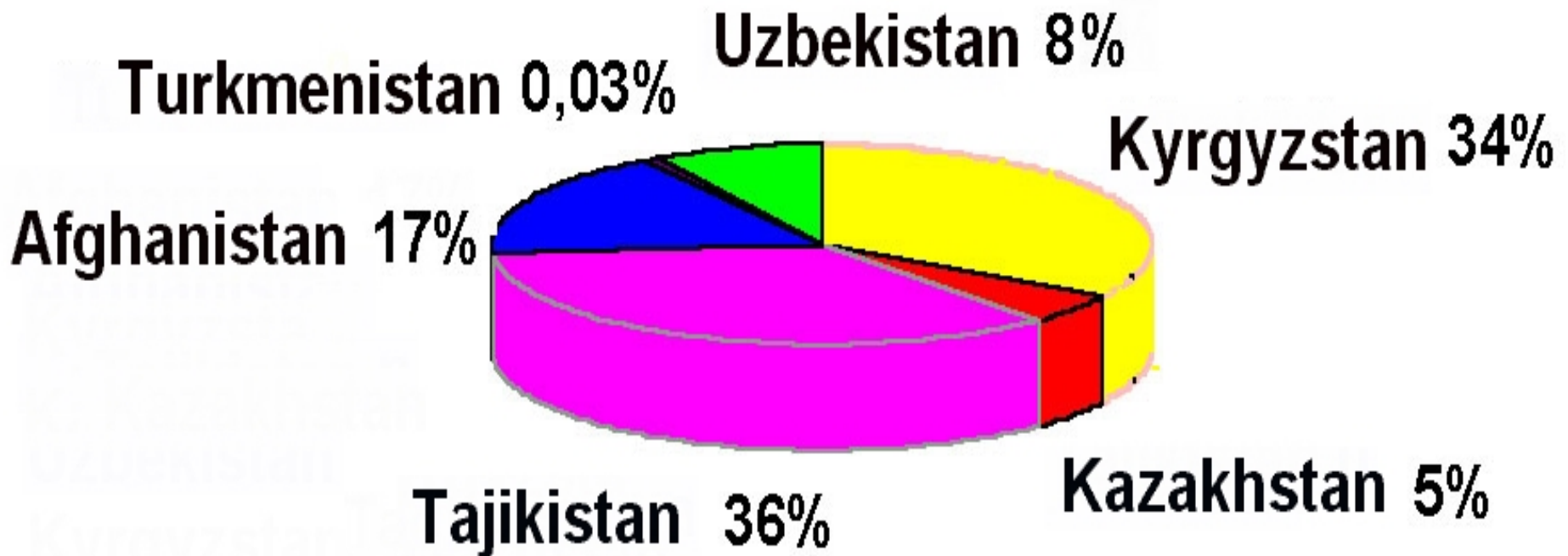
Water management

- in 1992 of Central Asia countries Interstate Coordination Water-economic Commission (ICWC) with its agencies was established.

- This organization adjusts the questions of unified management and use of Aral Sea basin resources in interests of all countries in accordance with environmental requirements.

Water management

In the Republic of Uzbekistan the state organizations responsible for water resources management include:

- *The ministry of agriculture and water management* is in charge of distribution and use of surface waters on the territory of republic;

- *The ministry of energy and electrification* operates hydroelectric power stations and the water reservoirs connected to them, now it is transformed into the State Incorporated Company (SIC) "Uzenergo";

- *The ministry of municipal services* (MMS) is responsible for development the policy, coordination, standards, development of management and technical development of municipal water sector. Now those functions were assigned to *the Agency " Uzkommunhizmat "*;

Water management

- *The state committee of geology and mineral resources* monitors and controls the conditions of underground water;
- *The governmental agencies on the level of region, district, city;*
- *The Directorate-general for Hydrometeorology* carries out monitoring for quantitative and qualitative status of waters of rivers, lakes and water basins;
- *The state committee for nature protection* is leading organization to control for rational use and protection of natural resources and charged with ecological monitoring, control and development of national ecological strategy, directly subordinate to the Parliament (Oliy Majlis).
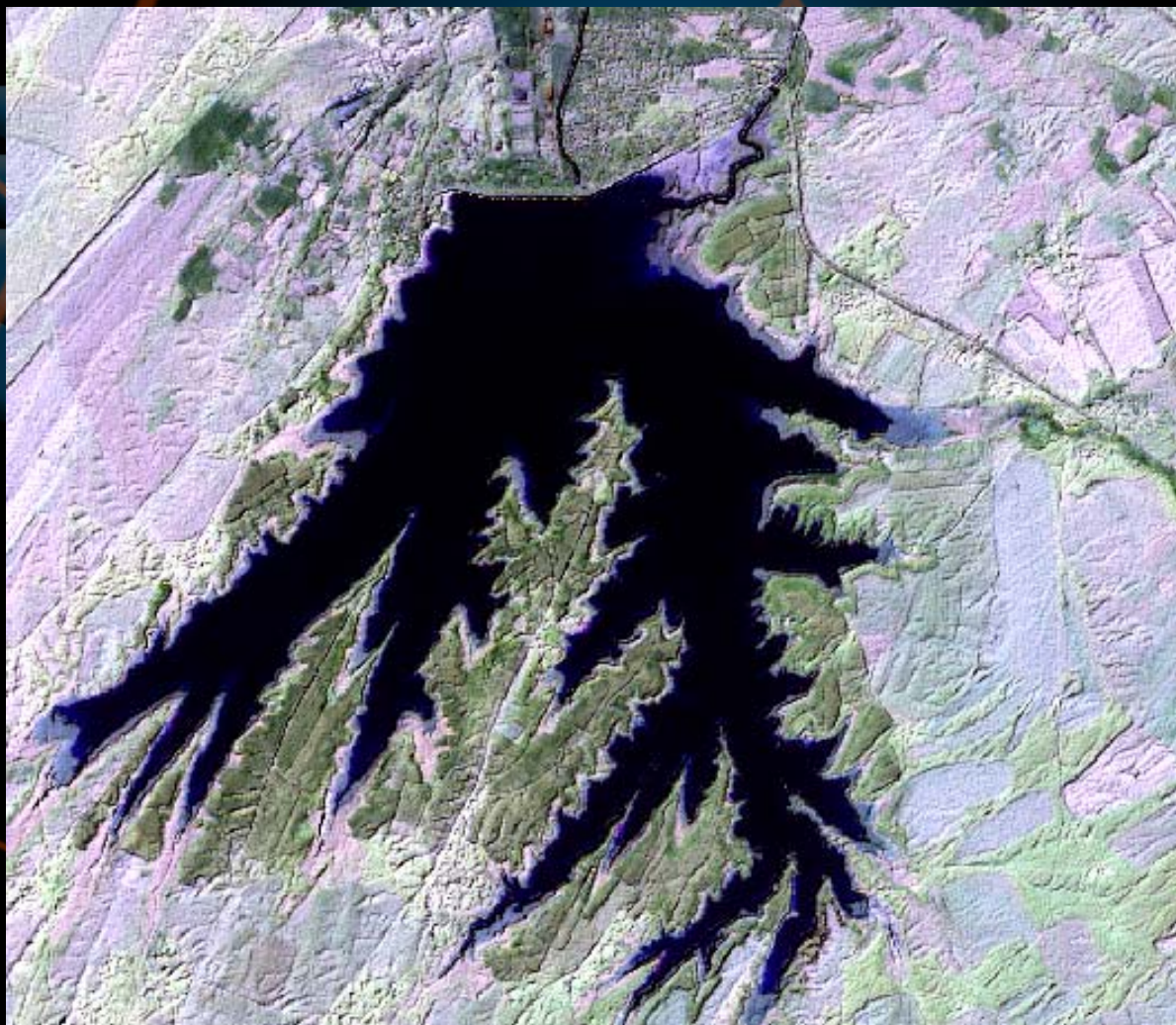
Space technologies

- In the Uzbekistan the basic organization responsible for development of space technologies is « the Center of Space Researches of the Academy of Sciences of the Republic of Uzbekistan », scientific development are realized by Tashkent Scientifically Research Institute of Space Instrument-making.

- The methods and technologies of processing of the satellite information in the decision of problems are being developed and used in:

- **meteorology**, including the development of cloudy systems and the forecast of especially dangerous phenomena of weather;

- **hydrology**, including the assessment of conditions of large lakes, water reservoirs and the methods of the forecast a flow of the mountain rivers, the assessment of influences large flooding and droughts;

- **agricultural meteorology**, the productivity of agricultural cultures, and also desertification and assessment of a biomass of deserted pastures;

- **glaciology**, definition of characteristics the dynamics of a snow cover in flat and mountain territories. The assessment of glaciating the mountain territories of the region.

Space technologies

- The majority works on the lakes conditions' monitoring have been conducting with use the information of the resource satellites (Lansat, the Resource, ASTER).

- From operating the meteorological, resource and geodesic satellites the operative divisions of the ministries on a constant basis receive only the information from meteorological satellites the Meteor, METEOCAT and NOAA.

Processing information from Landsat-7 for Katta-Kurgan water-reservoir

ТашНИИ КП

8 April 2000 year

2 November 2000 year

The Aral Sea, the lake Sudochie

Space technologies

- On the basis of processing digital satellite information NOAA of the system AVNR in the operative divisions carrying out the study of lakes the method of assessment the following parameters is offered:

- the water surface areas of the large lakes

- the areas of obliteration of lakes by water-resistant plants
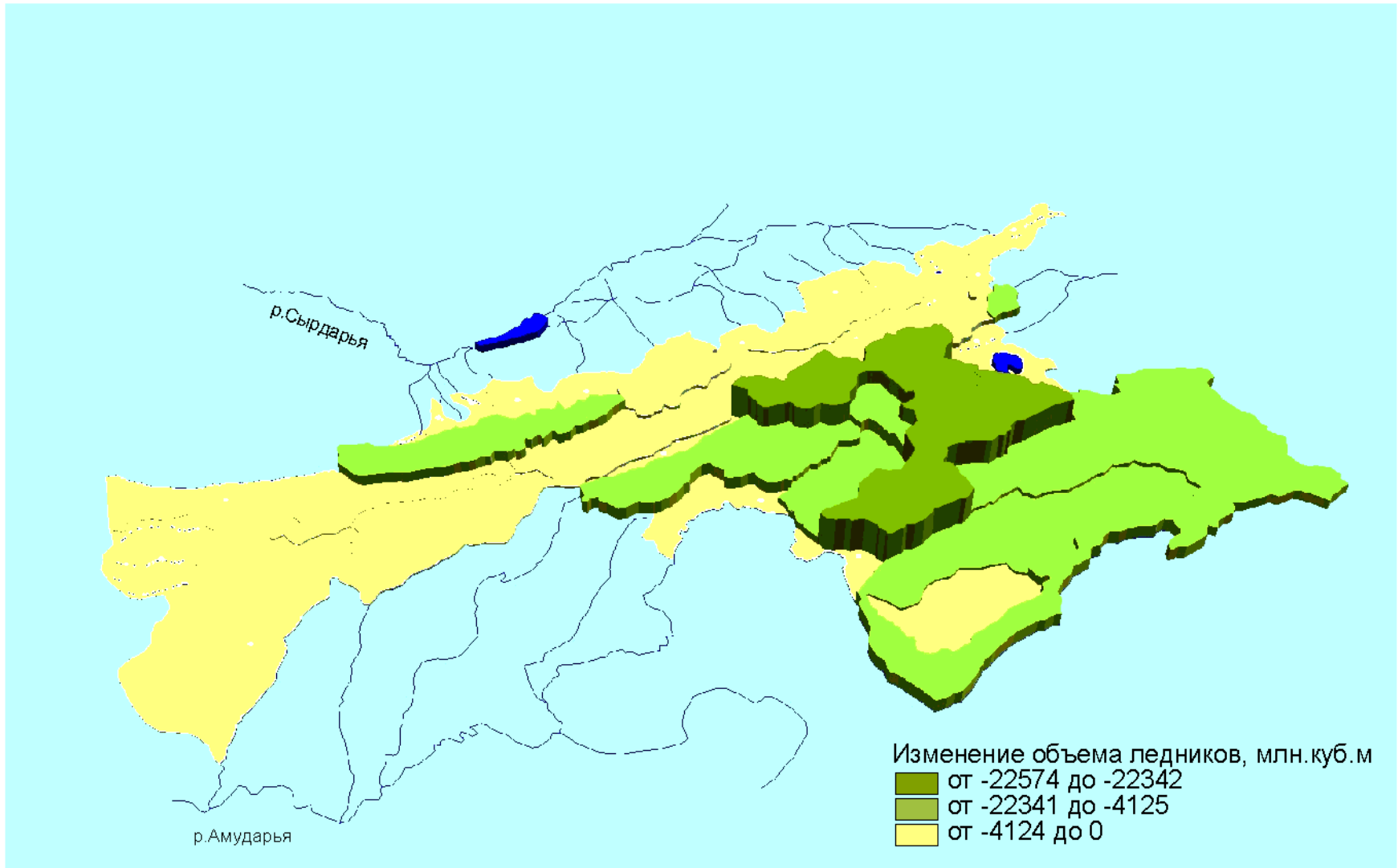
- the thermal regime and the ice phenomena

The small-scale-enterprise "SHOLIKOR"

ТашНИИ КП

Space technologies

- There is the work cataloguing of glaciers of selected river basins of Alai, Tutkestan and Zaravshan ridges of Gissar-Alay mountain system, which, in tum, are a part of Pamir-Alay mountain system, was fulfilled. Within the framework of collateral with Earth Remote Sensing Data Analysis Center (ERSDAC) ASTER Research Opportunity (ARO) scheme (ID AP-0290) the thematic processing of a number of the space images on date of 2001 and 2002 was produced.

- According data for 2001 the total area of glaciers of Gissar-Alay study area amounted to 482.53 km2, in 1980 and 1957 the total area of glaciers of these basin was 511.44 and 572.03 km2, accordingly. In spite of the global warming from middle XX century till the present time, there is fact that for period from 1980 to 2001 the mean annual rates of degradation of glaciation are approximately twice lower then for period from 1957 to 1980 – 0.27% per one year and 0.46%per one year, accordingly.

Changes of the Pamir-Alay Glaciation Extent in the 2-nd Part of XX Century

Изменение объема ледников, млн.куб.м
- от -22574 до -22342
- от -22341 до -4125
- от -4124 до 0
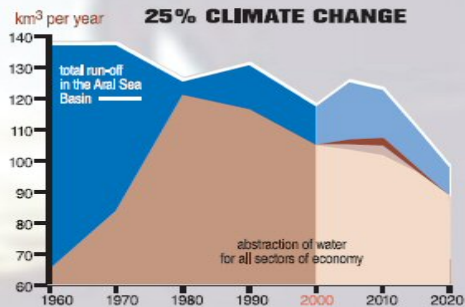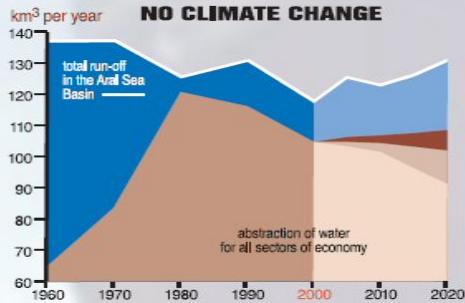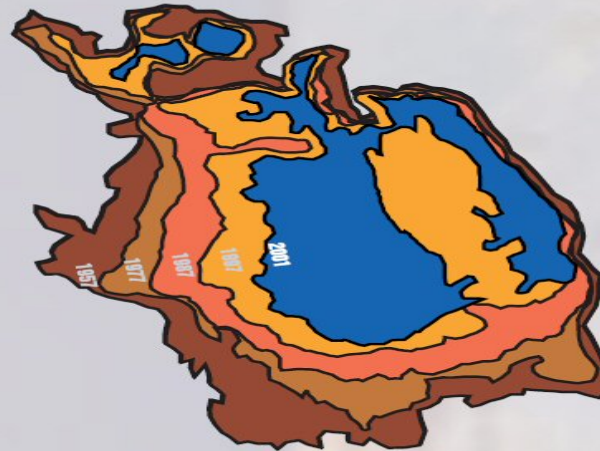
р.Сырдарья

р.Амударья

The Aral Sea

- For 40 years the sea level has gone down to 22.5 m., the area was reduced three times. Actually the sea has been divided into three parts. The analysis of dynamics of morphometrical characteristics of the sea determined on the satellite pictures allow to fix, that the level of the small sea last decade is characterized by small fluctuations in limits 39-42 m. The intensity of downturn of the sea level of the big sea is on average 39sm/year.

THE ARAL SEA: CHANCES OF SURVIVAL?

SCENARIOS OF WATER CONSUMPTION IN THE ARAL SEA BASIN

NO CLIMATE CHANGE

km³ per year

total run-off in the Aral Sea Basin

abstraction of water for all sectors of economy

1960 1970 1980 1990 2000 2010 2020

25% CLIMATE CHANGE

km³ per year

total run-off in the Aral Sea Basin

abstraction of water for all sectors of economy

1960 1970 1980 1990 2000 2010 2020

SCENARIOS: optimistic intermediary business as usual

DEGRADATION OF THE ARAL SEA (no climate change)

total area

1960

59%

1990

41%

2000

28%

2020
business as usual scenario

44%

2020
optimistic scenario
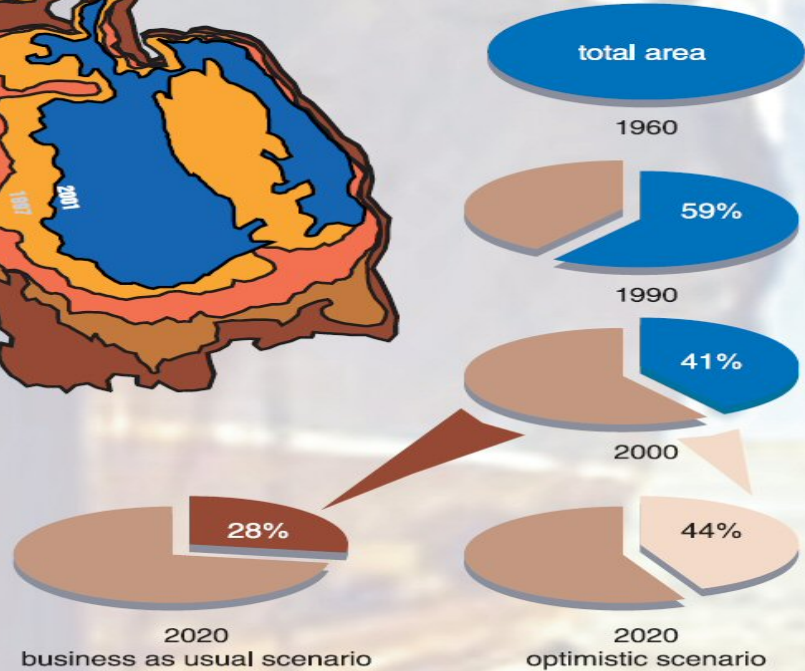
WATER

Aral Sea Basin Program -2 (ASBP-2)

- Prepared by board of International Fund for Saving of Aral Sea;

- Approved by governments of Central Asia;

- Duration – 2003 – 2010;

- Main goal: Development of coordinated mechanisms on comprehensive by water resources of the Aral Sea Basin

Thank you!