

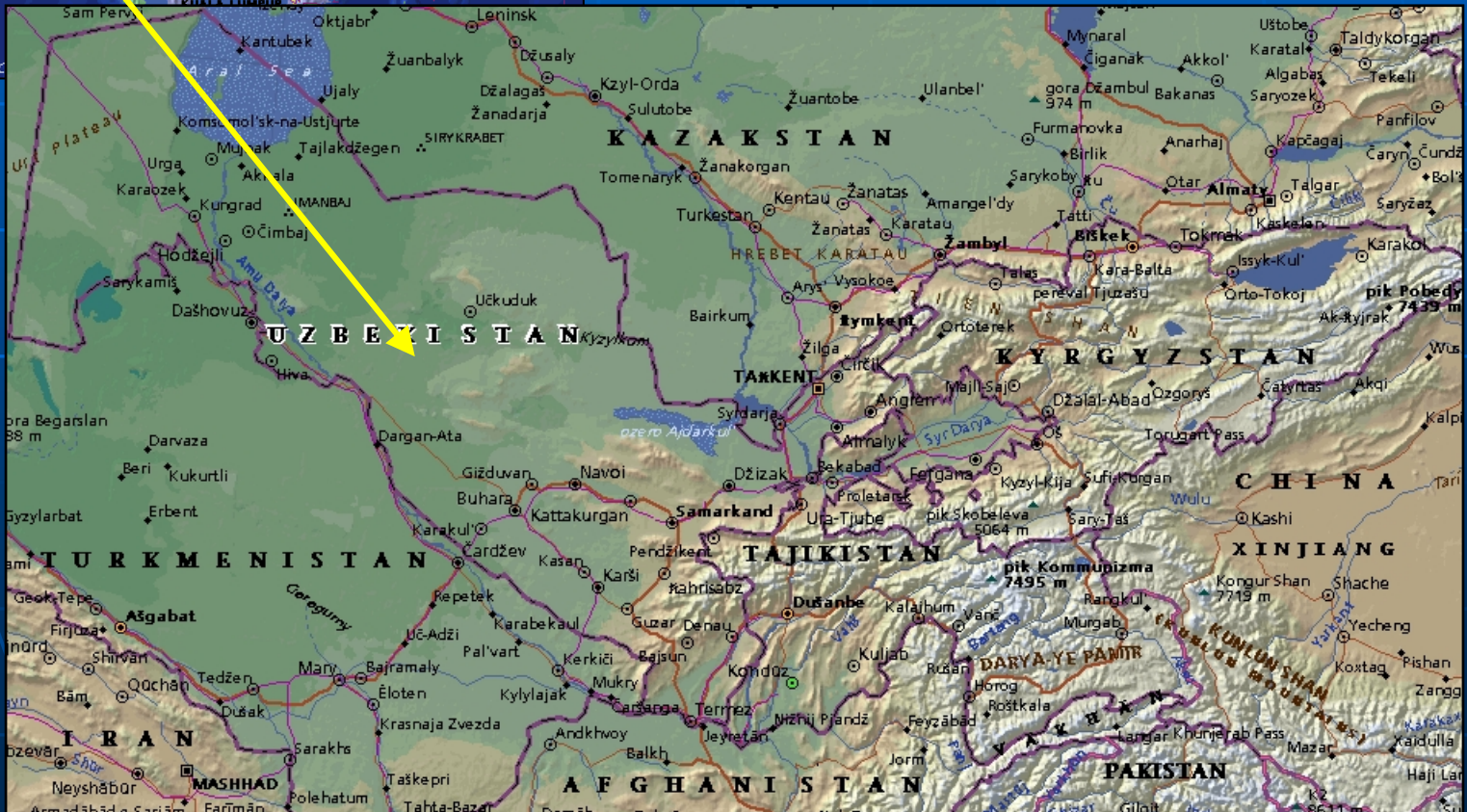
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CLIMATE CHANGE IMPACT ON THE RIVER RUNOFF IN CENTRAL ASIA: RISKS OF WATER MANAGEMENT

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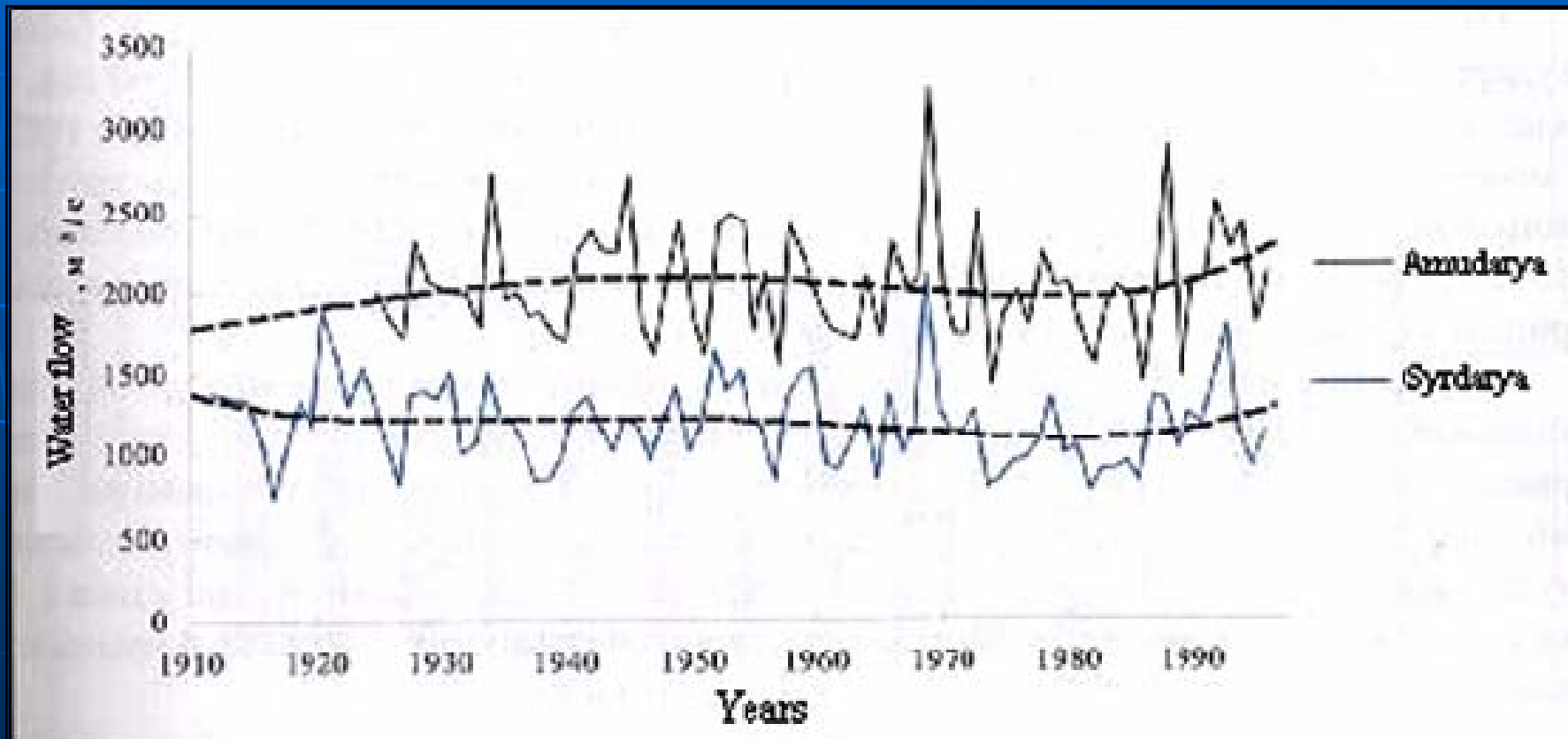
The problem of water supply deficit exists in many countries of the world, especially in the dry countries of Asia.

It is supposed that the problem of water supply deficit will become more critical to meet the utmost demand of water, which is a result of the industrial and agricultural development under the growth of population. The forthcoming climate changes will possibly increase the shortage of water. The developing countries and the countries with transitional economy located in arid and semiarid regions are very vulnerable under the influence with the climate changes and also experienced with a number of technical and financial difficulties. The future consequences resulted from climate changes will depend on the initial condition of water supply and water control systems.

The temporary unsteadiness of quantity and quality of water resources is rather significant. In the regime of water objects it is occurred the seasonal (annual), multiyear (from year to year), secular fluctuations and alternation of high-water and low-water periods.

The surface water resources of Central Asia in a whole are mainly generated in the mountain area and basically from atmospheric precipitation of the cold period, the multiyear distribution of which is determined by the peculiarities of synoptic processes and orography of the region. The interaction of moisture-laden flows with a complicated relief occurs a high space unsteadiness of precipitation and flow of some rivers. The main volume of flow is concentrated in the Transboundary Rivers that are jointly used by the Central Asia states.

THE MULTIYEAR CHANGES OF WATER RESOURCES OF THE ARAL SEA BASIN: THE AVERAGE ANNUAL WATER DISCHARGES (M³/SEC) IN SECTION LINES OF KERKI AND BEKABAD AND EMPHASIZED POLYNOMIAL TREND.

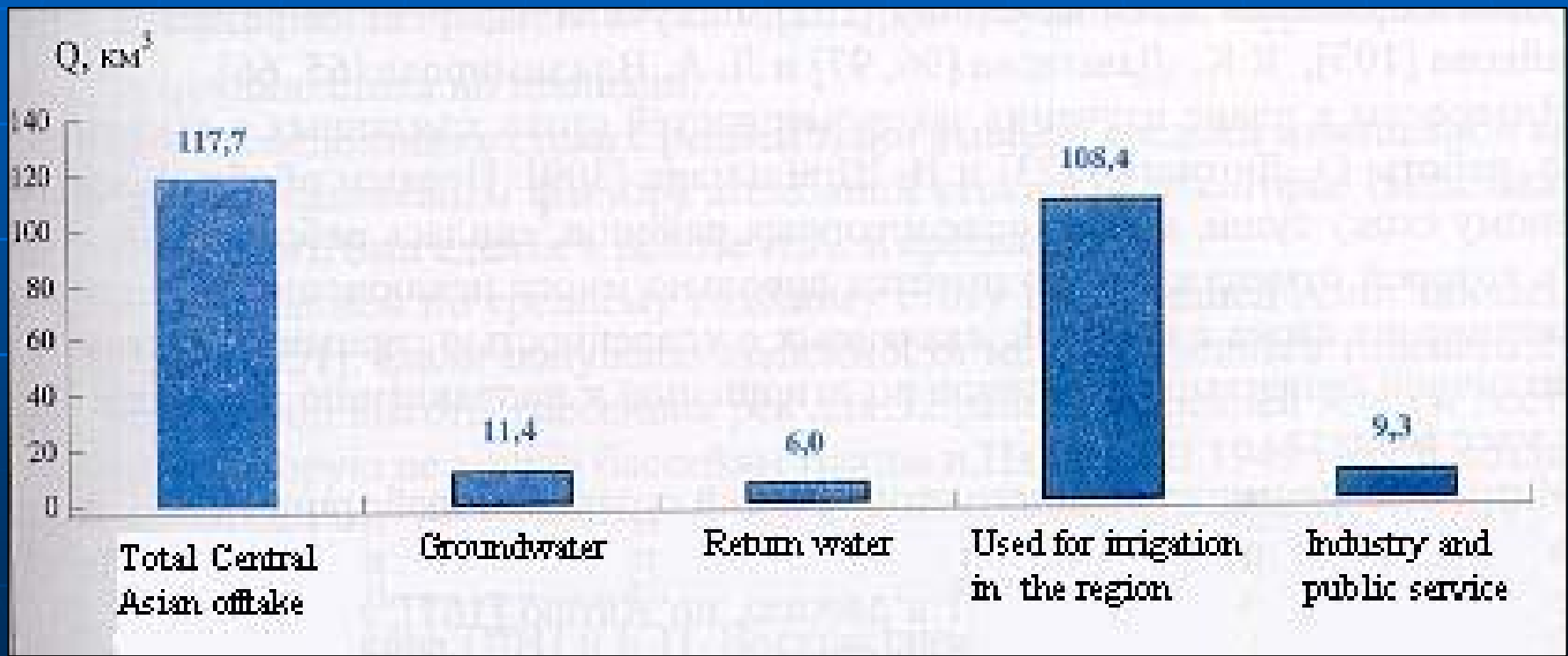


The natural regime of flow is substantially distorted by the water draw off for irrigating, drainage water discharge, and also reservoirs that infringes their hydrodynamic and hydrochemical regimes.

Ground waters of the Aral Sea basin are formed as a result of precipitation, pond filtration, river-beds, channels, lakes, and irrigated lands. The main user of water resources is farm irrigation structures, which use more than 90% of total water resources available in the region.

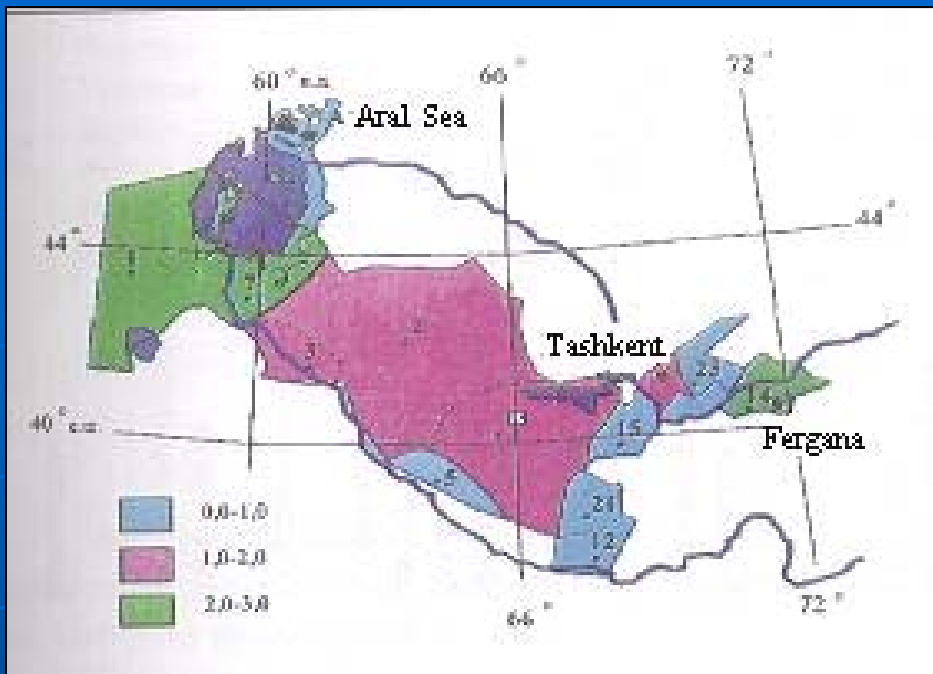
The climatic and hydrological processes are well demonstrated in the mountain river basins of high zone. The value of precipitation in the mountain regions is increased due to the altitude but evaporation is decreased.

The structure of drawoff and use of water resources (km³) in Central Asia for the average ratio of water content in 1990.

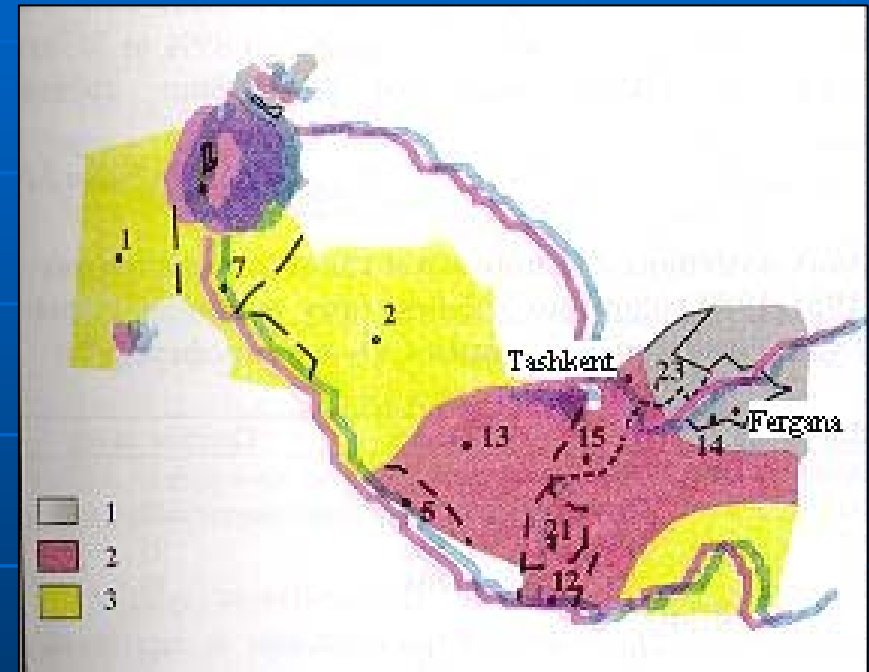


NOWADAYS IT IS RECOGNIZED THAT THERE ARE MULTI-MILLENNIUM AND MULTI-SECULAR CYCLES OF FLUCTUATIONS OF WATERING, WHICH ARE CAUSED BY THE NATURAL REASONS (CHANGE OF SOLAR RADIATION INTENSITY, FLUCTUATIONS OF THE CENTER OF GRAVITY OF THE SUN-PLANET SYSTEM, CYCLIC CHANGES OF SLOPE OF AXIS OF THE EARTH SPINNING, CYCLIC FLUCTUATIONS OF LOCATION OF POLES, ETC.).

WHEN ADDING TO THE ABOVE NATURAL PROCESSES OF THE ANTHROPOGENIC INFLUENCES ON CLIMATE AND CHANGE OF FLOW UNDER IRRIGATION INFLUENCE, THEN THE CONCLUSION IS THAT THE AVERAGE VALUES OF FLOW, WHICH WERE OBTAINED DURING CERTAIN PERIODS WHICH ARE LESS THAN FLOW CHANGE INFLUENCED UNDER THE ABOVE-MENTIONED REASONS AS “STANDARDS” OF FLOW, HAVE NO SENSE. IT IS WORTH TO MENTION ABOUT THE AVERAGE VALUES OBTAINED DURING THE TEN-YEARS BECAUSE THE LONGEST SERIES OF OBSERVATIONS OF THE RIVER FLOW OF CENTRAL ASIA DO NOT EXCEED THE 90 YEARS.



The change of the average annual air temperature by 2030-2050 in Uzbekistan with regard to the basic climate standards during 1961-1990. The figures are the numbers of climatic regions



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

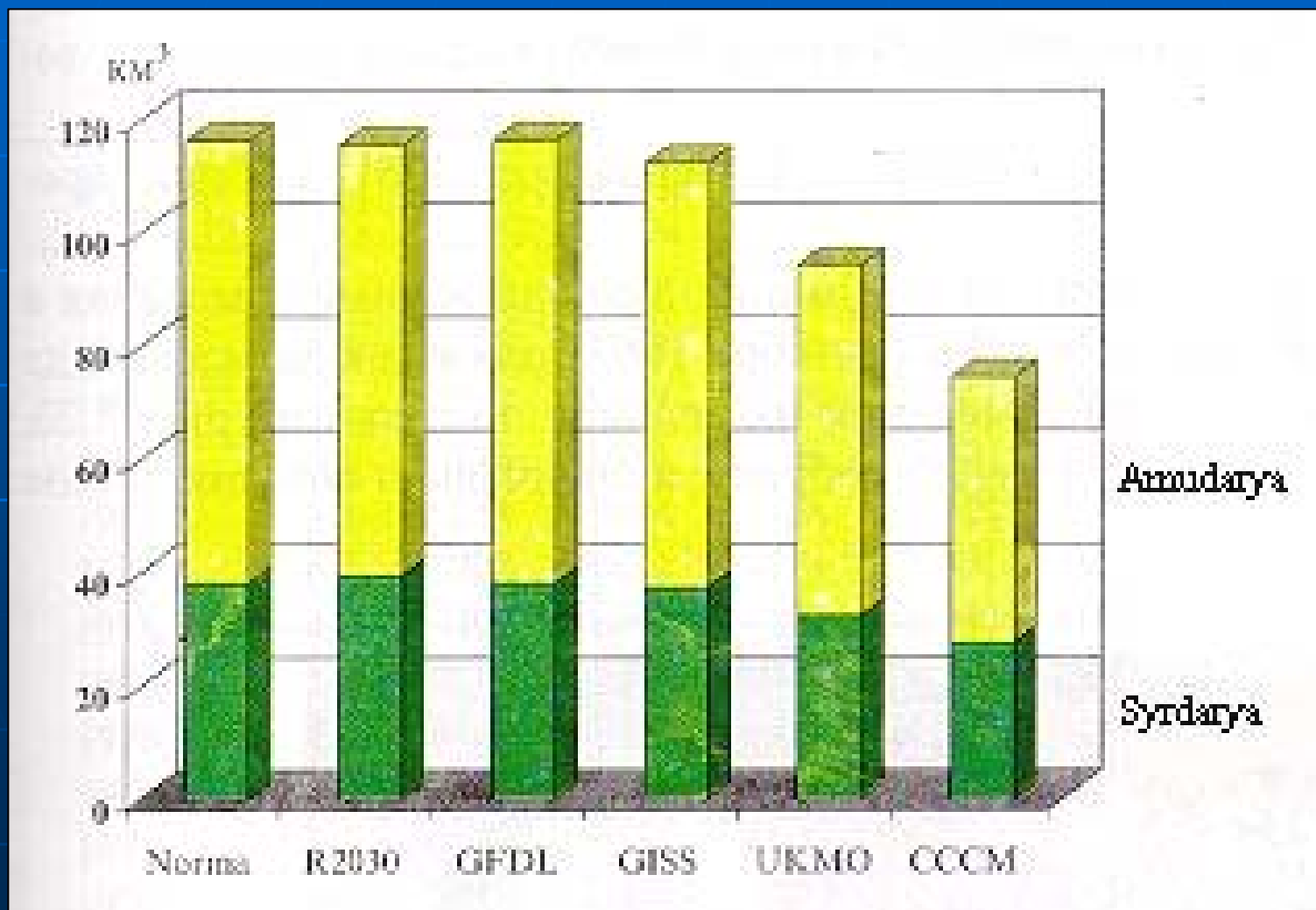
ON THE BASIS OF THE DATA AVAILABLE IT COULD BE CONSIDERED THAT THE UNSTEADINESS OF THE RIVER FLOW OF CENTRAL ASIA ACCORDING TO TIME DURING THE PERIOD OF OBSERVATIONS IS LESS IN COMPARISON TO THE PLAIN RIVERS OF OTHER REGIONS. IT GAINS FROM THE ETERNAL SNOWS AND GLACIERS, WHICH ARE THE MAIN PART OF THE FLOW OF MANY RIVERS AND MELTING OF WHICH HAPPENS MORE INTENSIVELY DURING THE YEARS WITH A HIGH SUMMER TEMPERATURE AND LESS INTENSIVE DURING COLD YEARS. IT PROVIDES THE RESERVES OF SNOW AND ICE, WHICH BEING ACCUMULATING FROM YEAR TO YEAR. THE FLUCTUATIONS OF THE AIR TEMPERATURE FROM YEAR TO YEAR UNDER THE CONDITIONS OF CENTRAL ASIA ARE LITTLE.

The scenarios of possible climate changes of Uzbekistan and close-by mountain regions based on the output results of the general circulation models (GCM). As is well-known, almost all known climatic models present an increase in the average air temperature on Central Asian territory. The development of the regional climatic scenarios based on the output results of GCM for temperature and precipitation due to Technical Manual of IGECC.

There were output results of models of general atmosphere and ocean circulation (National Center for Atmospheric Research (**NCAR**) data). The results were taken from the database “Climate Model Output Data” in the balance state for the present-day CO₂ concentration level in the atmosphere (check forecasts) and on the conditions of its doubling (2xCO₂):

- **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 annual Amudarya and Syrdarya flow at different scenarios of climate change



THE CONDUCTED SHORT ANALYSIS OF CHANGES OF THE COMPONENTS OF WATER RESOURCES, WHICH FORM THE ZONE OF FLOW GENERATION, DENOTES THEIR DEPENDENCE ON CLIMATIC FACTORS, BY WHICH THEIR VULNERABILITY FROM THE INFLUENCES OF CLIMATE CHANGE IS DETERMINED.

THE SITUATION IN THE REGION IS INTENSIFYING WHEN USING COMPLETELY OF THE RENEWABLE SURFACE WATER RESOURCES WHERE THE RATIO OF FLOW WITHDRAWAL EXCEEDS 1 DURING LOW-WATER YEARS BUT THE DRAW OFF FROM A RIVER DURING HIGH-WATER YEARS EXCEEDS THE PROVISION FLOW BY 10%.

What is local problem and what are the requirements (data, tools, training, etc.)?

- Training for Hydrologists on Remote sensing information using
- Tools for water discharge measurement and snow melt estimation
- Development of data base

What is the best practices you consider ?, how the local problems were solved?

- Regional workshop and scientific seminars
- Regional Hydrological Centre for Aral Sea basin
- Help from International Organizations
- Using a NOAA satellite image for snow melt analyze

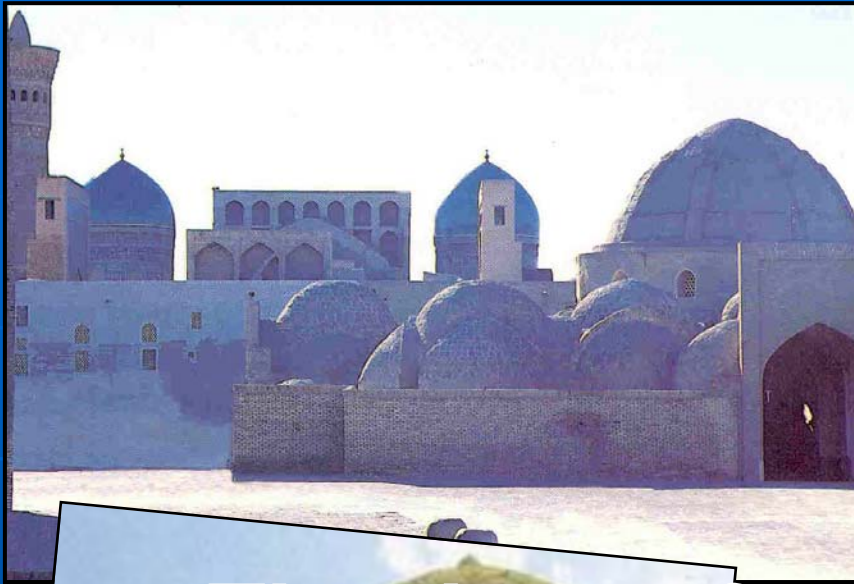
What capacity building activities are being made in your country?

Remote Sensing Information exchange

Workshops

What regional or sub-regional application capacity building project do you propose?

- Workshop for scientists of Hydrology and Water management
- Scientific work both with developing and develop countries



Thank you for your attention !

