FORECASTING OF DROUGHT IN CENTRAL ASIA

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Summary: For the Central Asian region the drought means, first of all, the deficit of the water resources that is why the forecasting of the water availability in rivers in the years with the water deficit is of the utmost importance.

Climate change in global scale towards warming is accompanied with increase in an amount of extreme weather and climate phenomena (droughts, high temperatures, heavy precipitation, floods, hurricanes and others), causing considerable damage. To control extreme events studying extreme phenomena is needed in different regions as well as an evaluation of their frequency change induced by warming.

For the Central Asian region drought is first of all, deficit of water resources therefore water river forecast in dry years is of a great importance.

Scheme of Republic of Uzbekistan

Studying observed drought extremes in dry years implies analyzing frequency of extreme precipitation deficit (or index of drought) according to the data of the stations with a long period of observations. Advancing in drought forecast is based on the evaluation of water resources change in the formation zone when occurrence of extremes (extreme values of precipitation and temperatures) and analyzing a range of runoff fluctuations and evaluation of its probability.

The problem of droughts forecasting is closely related to the problem of long-term forecasting of temperatures and precipitation. Despite of numerous efforts there are great successes in long-term forecasts of monthly and seasonal anomalies of precipitation and temperatures nowhere in the world. Especial problems when long-term forecasting emerge in continental regions of moderate latitudes, where there is a natural changeability of temperature and precipitation, it is typical for Central Asia. In the Central Asian Research Hydrometeorological Institute several objective methods of forecasting anomalies of precipitation and temperatures have been developed, which are used for assigning meteorological situation for a period of lead time forecast for long-term forecasting hydrological drought.

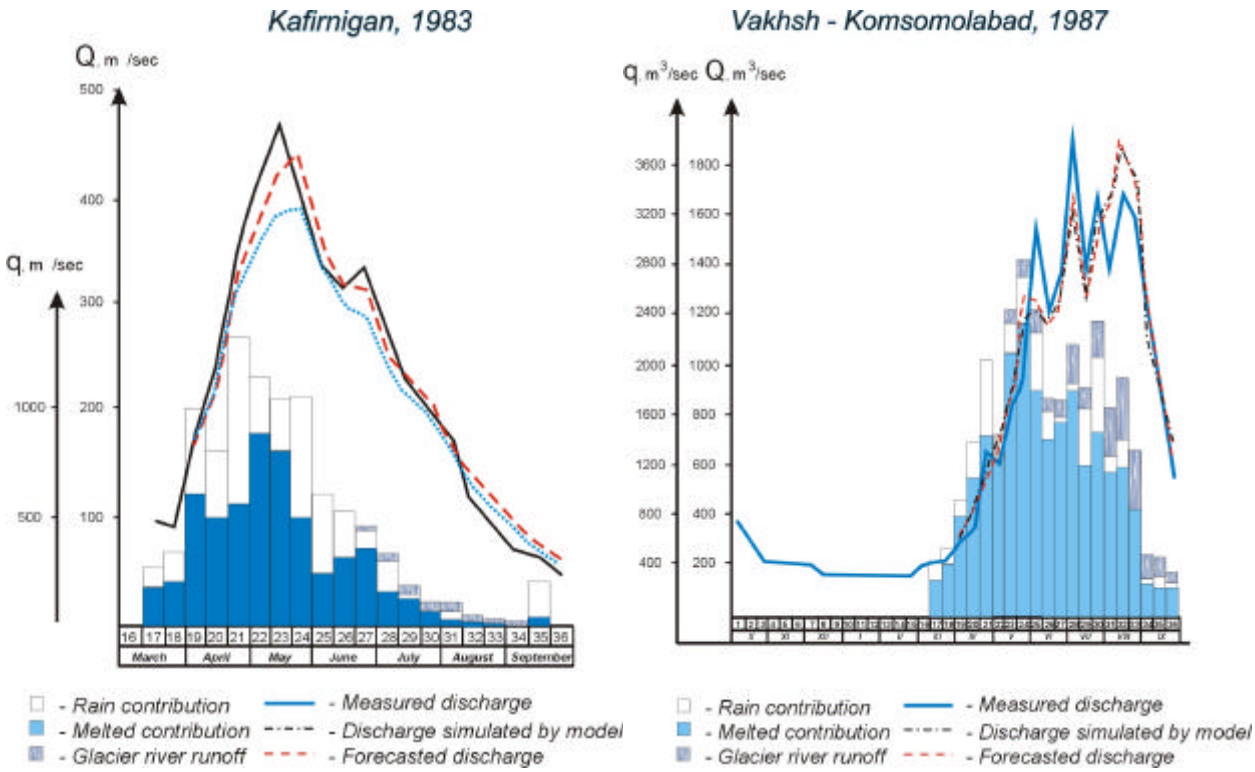
To date in Central Asian Research Hydrometeorological Institute a big experience has been accumulated in designing the models of river runoff formation and their use for hydrological calculations and forecasts of the Aral Sea basin rivers.

The models developed describe the process of river runoff formation from revealing regularities of precipitation formation, calculation of melted and rainfall input on the watershed surface and to their transformation into the hydrograph of runoff in outlet river station.

As a model of transformation determinate model with lumped parameters is used. The next important direction of mathematical models improvement is development of stochastic and determinate probabilistic models of runoff transformation, which enable to obtain conditional probability density of discharges and to define a range of expected values of forecasted discharges.

Input data are measured precipitation and air temperature, channel data, orographic and other physico-geographical characteristics of the studied hydrological object (river basin). Output data are melted and rainfall inputs, snow water equivalent with distribution through altitude zone and finally, river runoff hydrograph.

The most important stage of creation and adaptation of the mathematical model of snow cover and mountainous river runoff formation but in the same time the least informatively provided is reliable estimate of geographically-temporal distribution of precipitation. In the mountainous regions dependence between precipitation and height of site and other orographic characteristics are local ones. But in the same time from the experience of previous investigation the fields of precipitation in the inter-mountainous regions have complicated structure depending on many factors such as height of site, distance from orographic nodes, degree of openness towards moisture-laden air flows etc. Their simultaneous acoount not always leads to positive results.



Hydrograph oj Kafirnigan and Vakhsh rivers basin

In addition, hydrologists of Uzbekistan develop and use mathematical models designed for evaluations and forecasts. In Uzbekistan the runoff formation models have been developed and approbated, which include the model of snow cover formation in the mountains, model of glacier flow and the model of melted and rainfall input transformation. This model complex is being adapted for forecasting low water level on main rivers – indicators of the region, which enables to define water supply in the region during the years with low water content.

To warn about drought the reliable informative basis is needed and as an alternative source of information the set of regional climate scenarios can be used, which has been created on the base of modern global climate models outputs. This information allows defining expected range of change in river water content in dry years for each geographical region. Such climate information will be useful for assessment of possible damage and selection of measures for its reduction and prevention.