Description of the forecast of spring flood volume of the Ilek River

Subject

Introduction

The water resources of the Aktobe region, which is under humid conditions, are used for variety of purposes, but primarily for water supply, water supply of liman irrigation and industrial needs. Especially, the role of the region's water resources during the creation of new settlements has increased.

At present, there is a significant water shortage in the Aktobe region, especially in low water years. To cover the water balance deficit, to improve water supply in Aktobe city, Chilik village, etc., irrigation of suburban lands, etc., designed in 1975 Kargaly reservoir and in 1987 Aktobe reservoir on the Ilek River.

Economically, the most rational and correct decision on the use of water reserves in reservoirs, the magnitude of their work before the spring high water can be taken only with a reliable forecast of the water content of the Ilek River in spring period. This task was devoted to the solution of this problem.

1 Hydrography

The distribution of river network and lake reservoirs in the area under consideration is in connection with the meridional location of the main watershed of the Mugodzhar mountains and the aridity of climate in the greater part of it. According to the hydrographic conditions, the territory under consideration can be divided into three parts: the western, belonging to the basin of the Caspian Sea, the eastern, occupied by lower part of the catchment area of the Turgai River and the Shalkar-Tengiz hollow, and the southern - drainage, adjacent to the Aral Sea. All rivers of the region, with exception of Turgai and Ul'kayak, originate within it.

In the western, most watered part of region, there are about 580 rivers and temporary streams 10 km long and more, with total length of 15,100 km. Many left-bank tributaries of the Ural River, rivers of the Ural-Emba interfluve and the basin of the Emba River flow here. There are few lakes and they are located mainly on the catchments of the Emba, Sagiz and Uil rivers.

In the eastern part of region, there are approximately 190 rivers and temporary streams 10 km long and more. Their total length is 6,100 km. The hydrographic network is sufficiently developed only on the right bank of the Irgiz River basin. The rest of this region has many different in size fresh and salt lakes.

The southern, drainless part of the region adjacent to the Aral Sea is characterized by rare network of temporary streams (there are about 230 streams 10 km long and more, with total length of 5800 km), ending mostly in solonchak depressions - sors, and the presence of small number of salt lakes.

2 METHOD FOR FORECASTING THE VOLUME OF SPRING FLOODS

Features and main factors of formation of spring high water

Spring high water is a characteristic feature of the annual water regime of flat rivers, caused by the rapid melting of snow accumulated during the winter. It is the main phase of the water regime of the rivers of Western Kazakhstan. It accounts for 60 - 80% of the annual flow. The water discharge during the flood period is hundreds of times higher than the low water discharge, so it is accompanied by river floods. In many-water years, these spills sometimes acquire the nature of natural disasters, causing great damage to the national economy.

Flooding begins in southern part, usually in the middle of March, in the rest of the territory - in late March - early April; in eastern regions it occurs 7 to 8 days later than in western regions. The maximum of high water is usually observed in the first - second decade of April. The average duration of flooding ranges from two weeks to 1 to 2 months on larger rivers, while on small logs floods last an average about 10 days. The high water in south of region ends in the first half of April, in the rest of its regions - in the second half of April, and on relatively large rivers it drags on until the second half of May - early June. In the spring period, most of the rivers pass through most of the annual runoff. In south-eastern region, the spring runoff is almost equal to the annual flow. The only exceptions are large rivers that have transit drain to the low water that forms in the more high-water upper parts of their basins, and those small rivers that receive a significant inflow of groundwater. To the northwest, the ratio of spring and annual runoff decreases. In different years ratio of spring and annual runoff varies greatly. This is due to the fact that in the high water years the surface component of surface runoff increases significantly more than the underground one, and in low-water years - on the contrary.

Spring flood is almost completely formed due to snowmelt waters. Especially great is the role of meltwater coming from elevated areas of the terrain. After very little snow winters, on the contrary, the spring runoff is determined mainly by snow reserves accumulated in river beds and temporary watercourses. On the small watercourses strong influence on the formation of the spring flood provides smooth snowmelt. With the increase of catchment area, the role of this factor is noticeably weakening.

No less important factors in the formation of spring flood are precipitation and air temperature in the autumn period, which determine the degree of moistening of soil before snowmelt and, thus, affect the amount of loss of meltwater. Significant autumn precipitation moistens the soil, and low air temperatures contribute to its strong freezing, resulting in low losses on filtration during snowmelt. The drainage coefficients in such springs reach values of 0.7-0.9. With small precipitation and mild temperature conditions, there are large losses of meltwater to infiltration. The coefficients of spring runoff can be reduced to 0.05-0.02. Since the degree of freezing

of soils remains more or less constant from year to year, the magnitude of losses for infiltration during spring flood depends mainly on degree of the preceding autumn moistening of soil. An important role is played by liquid precipitation falling during the melting of snow, which have approximately the same effect on the volume of spring runoff as snow cover. In other words, the conditions for draining and absorption of these precipitates are the same as the thawed water.

Hydrometeorological conditions of spring determine the course of snow melting and thawing of soil, and, consequently, affect the magnitude of meltwater loss and intensity of concentration of these waters in the riverbed.

Intensive snowmelt, which usually takes place in amicable springs, and the later onset of thawing of soil with respect to the beginning of arrival of thawed waters in the river, causes an intense surface runoff and, as a rule, high maximum water flow. The influence of terrain relief affects, on the one hand, to the amount of precipitation and their distribution along the catchment area, on the other hand it determines the slopes of the catchments and river beds, on which the water runoff rates depend, and hence the losses, volume and maximum flow of floods

The presence of closed relief depressions in the catchments of rivers (saucers, traps) contributes to surface accumulation of thawed waters. As a result, some of the meltwater, especially in low-water years, does not enter to river beds and does not participate in flood formation. In the most high-water springs, depressions are filled with meltwater, and runoff to the river occurs from the entire area of its catchment area

From all the above, it can be concluded that the main factors in formation of spring flood are maximum snow reserves, spring precipitation and autumnal moisture. The most significant in terms of volume and maximum spring floods are formed in amicable springs with significant snow reserves and sufficient pre-spring moistening of the watersheds soils.

3 Initial data for development of methods for forecasting the volume of spring floods

When developing methods for forecasting spring flood, the water balance equation is taken as the basis.

The initial data for release of forecast are the maximum snowfalls for the winter period (December-February), autumn moistening of soil and total precipitation for the period from the date of stable transition of average daily air temperature 0 ^{0}C up to date of the maximum high water.

The dependence of the volume of runoff of spring flood R. Ilek from the supply of water in the snow cover, folded with precipitation during the snowmelt and autumn moisture index, calculated by the weather station Novoalekseevka