VARIATIONS IN THE ANNUAL RUNOFF ON AN EXAMPLE OF THE WEST DVINA RIVER

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The West Dvina River is representative transboundary European river which is flowing past on the territory of three countries: Russia, Belarus and Latvia. The river is referred to the West Dvina hydrological region. Length of the river compounds 1020 kms, basin space is 87.9 thousand square km. The basic inflows of the West Dvina River on the territory of Belarus are the rivers Usacha, Obol, Polota, Drissa, Kaspia, Luchosa, Ulla, Disna and Druyka.

The river is characterized by the mean incline of water surface 0.12 % and communal dip of the level on territory of Belarus 38 m. The river flows past in direction from east to west on Surozhskaya lowland, between Gorodokskaya and Vitebsk high grounds. Power supply of the river mixed (in the greater extent snow and ground). The feature of water regime is the high spring full-water, small summer-autumnal low-water with often rain full-waters and stable winter mean water. The annual runoff of the river compounds 666 m^3/s (Dzisko et al., 1994).

One of the major performances of the water regime of the river is its annual allocation of the runoff (AAR). The last results of basic researches of the AAR of the West Dvina River are referred to 60-th years of the XX century (Resources of day waters of USSR, 1966). The happening climatic variations and strengthened anthropogenic affecting essentially have influenced on AAR.

The purpose of the study is the estimation of the AAR variation in the West Dvina River under influencing of the natural factors and anthropogenic affecting in the period since 1961 till 2005 in relation to the period of observations since 1877 till 1960.

The AAR variations are investigated on three hydrometric stations of the West Dvina River on the territory of Belarus (Vitebsk and Polotsk).

As input data the series of long-term observation by monthly average runoff for the period since 1961 till 2005, given by republican meteorological center of the Ministry of natural resources and environmental protection of the Republic of Belarus, and also results of studies of AAR on the West Dvina River (Resources of day waters of USSR, 1966) are used.

In study the method of layout of seasons is accepted. According to this method for the West Dvina River for a limiting period the summer-autumn and winter are accepted, and for a limiting season summer-autumn is accepted.

For considered stations the hydrographs of the runoff for following groups of years on liquid water content are constructed: very much full-water (P = 5 %), full-water (P = 25 %), mean (P = 50 %), low-water (P = 75 %), very much low-water (P = 95 %).

The comparative analysis of hydrographs of the runoff of the West Dvina River is held in two acting stations (Vitebsk and Polotsk) during the period of observations of 45 years. The analysis has allowed revealing an abatement of the runoff in spring season and its magnification in winter season. The summer-autumnal runoff in Vitebsk station was diminished, and in Polotsk station was augmented. However data of variation are insignificant and do not exceed limits of natural oscillating. As a whole, mean annual allocation of the seasonal runoff of the West Dvina River looks like this:

1) Vitebsk station: spring (56 %), summer-autumn (29 %), winter (15 %);

2) Polotsk station: spring (55 %), summer-autumn (29 %), winter (16 %);

AAR for hydrological regions on seasons are: Ic – 48 %, 31 %, 21 %; Id – 57 %, 23 %, 20 % accordingly.

It is established that the shape of hydrographs has altered. Most legibly it is tracked for group of very full-water years. At first, the amount of freshet periods was augmented up to four; secondly, spike of an autumnal high water was offset. For example, in station of Vitebsk there was an offset since one month November for October. In mean on liquid water content years during observations since 1877 till 1960 the spring and autumnal high waters were supervised in April and November accordingly. In the last period since 1961 till 2005 two high waters (in April and December) also are supervised. For very low-water years the identical amount of high waters for last period and for the fist period is generic. Per full-water years in a Holocene the high water in a winter season was added. The hydrographs of the runoff for the low-water years for two stations are various. So, in station of Vitebsk three high waters in one year for two considered periods are fixed. The high waters differ only by month of passing. In station of Polotsk the high waters in the spring and autumn are supervised. The spring high water is necessary for April, and autumnal in 1961-2005 was offset since October for November. The rounded aspect of hydrograph of the runoff constructed for the last period is detected.

In the last period of observations (1961-2005) reallocating of the West Dvina River runoff in the course of the year takes place. It express in an abatement of fraction of the spring runoff and magnification of fraction of the winter runoff. The fraction of the summer-autumnal runoff was diminished in station of Vitebsk and, on the contrary, was augmented in station of Polotsk. Is detected, that the data of variation are insignificant and do not exceed 5 %.

The hydrographs of the runoff of very full-water and full-water group of years are characterized by many freshet periods come for April, January and October (November) months. In mean water years the offset of an autumnal runoff for December is detected. In turn, the hydrographs of the runoff for low-water years have more rounded shape.

Thus, natural-climatic factors and the anthropogenic affecting have rendered definite influencing on the runoff of the West Dvina River. Thus the playing key role in forming the runoff in considered period belongs to the natural-climatic factors.

References

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