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Spatial and temporal variations of water quality in the Belaya River Basin

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The aim of this research is to identify the spatiotemporal regularities of the maintenance of nitrogen compounds in the streams of the Belaya River basin. The dynamics of human activities in the catchment and intra and inter-annual changes in the water quality are analyzed for the period 1969-2007 years. The Belaya River is situated in the South Ural region and is one of the biggest tributary in the Volga River basin with catchment area of 142 000 km2. The Belaya River provides drinking water for a lot of settlements, it is used for industrial and agricultural water supply, fishery use, it is also a wastewater receiver for industry and housing and communal services.
More than sixty years the diverse economic activities are carried out in the Belaya River basin, the intensity of this activity is characterized by high temporal variability. The leading industries in the region are oil mining, petroleum processing, chemistry and petro chemistry, mechanical engineering, metallurgy, power industry, timber industry. About 50% of the river basin is used for agriculture.
Inter-annual dynamics of the nitrogen content in the river waters was identified on the basis of the long-term hydrological monitoring statistics at the 32 sites. It was found that the dynamics of the intensity of economic activities in the Belaya River basin is the cause statistically significant changes in the content of nitrogen compounds of the river network. Statistically homogeneous time intervals have been set for each monitoring site. Within these time intervals there were obtained averaged reliable quantitative estimations of water quality. Calculations showed that from the end of 1980 to 2007 the average long-term content of nutrients in the river waters is reduced in comparison with the previous period: ammonium nitrogen - in 1,6-7,5 times, nitrite nitrogen - 1,9-37,3 times, but the average concentration of nitrate nitrogen is increased in 1,4-6,6 times.
Empirical probability distributions of ammonia nitrogen, nitrite nitrogen and nitrate nitrogen concentrations for various phases of the water regime in all investigated monitoring sites were approximated by Pearson type III curve and the averages of the concentration values for the water regime phases, the coefficient of variation and asymmetry, as well as the values of the concentrations of nitrogen compounds in the range of 1-95% of frequency ware estimated. It was found that by the end of the test period, the average long-term values for nitrogen compounds become smaller MAC in many streams of Belaya River basin that points to the suitability of river water quality for fishery use. However, in some points of river network there may be excess of MAC.
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