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Causes and onsequences of the hydrological droughts in the south region of European Russia

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In the last decade the number of extreme low-flow periods on Russian rivers has increased significantly. The most severe water shortage currently observed in the Don and Volga basin. Also suffers from lack of water of Lake Baikal region, left-bank tributaries of the Lena. The most acute problem of water shortage is in the basin of the Don river. It is located in the south od European part of Russia and has an area of 422 ths km2, which is very densely populated (more than 29 million inhabitants). The river and its tributaries are the main sources of fresh water for the population. In addition, they play a key role in industries such as fisheries, recreation, shipping, hydropower (HPP Tsimlyanskaya). Don anciently was very famous for its biodiversity and the number of organisms of the floodplain ecosystems. However, at the present time due to anthropogenic stress and climate change, these figures dropped down.
This study is devoted to the complex analysis arising in the district. Don water shortage. As part of the research was carried out the spatial distribution of runoff, revealing its meteorological reasons of water shortage, the impact of water scarcity on the ecosystem in general and fish fauna in particular.
Hydrological drought is clearly manifested in the annual runoff only in the lower part of the basin. From 2007 the annual runoff probability here are higher than 80%. It was found that the longest (during record from 1930ths) duration of the event associated with rotation of water shortages on the left and right-bank tributaries of the river. In addition, the analysis of the spatial distribution of seasonal runoff probability showed that in the upper catchment hydrological drought is hardly observed: the rate accounts for 60% and lower. Drought has led to the transformation of the aquatic ecosystem of the Don river and its transition from oligotrophic to eutrophic state. The concentration of phytoplankton in the August - September during low flow period has increased 10 times. Deficit of water affected the reproduction of fish communities - for some species has decreased the number of young fish due to the reduction of spawning areas. At the same time, for others, warm water and improved low levels affected beneficially.
The unfavorable combination of natural and anthropogenic factors can be named as reasons for the origin of extreme low-flow period. On the one hand, the increase in the number of thaws and seasonal-floods in winter led to drawdown of snowmelt water in spring, increasing deadweight losses. On the other hand, in recent years it has increased anthropogenic press on the Don basin associated with the intensification of economic activities in the catchment area. This set of factors has led to significant damage from hydrological drought in 2007-2015 in the Don basin.This research was supported by Russian President Grant 2017
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