



Role of climatic and anthropogenic factors in recent and projected changes for large Russian rivers

Alexander Georgiadi, Nikolai Koronkevich, Irina Milyukova, Ekaterina Kashutina, and Elena Barabanova
Institute of Geography Russian Academy of Sciences, Laboratory of Hydrology, Moscow, Russian Federation
(galex50@gmail.com, 4959590033)

The role of climatic and anthropogenic factors in observed (from the end of the XIX by the XXI-st century beginning) and scenario changes of an annual and seasonal Volga and Don River runoff is investigated. The analyses of recent changes were based on the river runoff naturalization on the basis of regression relationships between the runoff of the main rivers and rivers-indicators (tributaries of the main rivers) (Georgiadi et al., 2013). Rivers-indicators are characterised by rather small anthropogenic influence on their runoff. The independent estimation of anthropogenic changes based on water use data statistics and water balance methods has been fulfilled (Koronkevich et al., 2012). It allows to estimate the influences of various kinds of anthropogenic factors and their complex as well. Both methods give close results.

The ensemble approach to long-term scenario projection of river runoff changes in the first third of the 21st century includes two methods: (1) a method of scenario estimations of runoff changes for the range of probable climatic warming scenarios based on monthly water budget model (Georgiadi & Milyukova, 2002; 2010; Georgiadi et al. (2011) and generalization of calculation results obtained by using the ensemble of global climate models (Meehl et al., 2007) and (2) a method of alternative scenario estimations for the water management system transformation caused by socio-economic changes and their impact on the river runoff (Koronkevich, 1990; Koronkevich et al., 2009; Georgiadi et al., 2008, 2011).

The investigation revealed the contribution of climate and the anthropogenic factors changes in the Volga and Don runoff changes during 1930-2007. It is shown, that in Volga and Don basins climatic and anthropogenic factors, performing in the same direction, reduced a snowmelt flood runoff, and, hence, an annual runoff. Thus the contribution of each of these factors to the runoff changes was approximately equal for the annual river runoff, and the role of anthropogenic factor in snowmelt flood runoff decrease has been more notable. At the same time a ratio of the contribution of these factors to the changes of low-water river runoff (during winter and summer-autumn periods) of the Volga and Don are considerably differs. But both factors increased the runoff during low-water period thus compensating the runoff decrease during snowmelt flood. On the Don they bring the equal contribution to river runoff increase for each of the low-water seasons (more considerable in the summer-autumn period). The Volga runoff increase during the winter low-water period is entirely caused by anthropogenic factors but the total weakly notable runoff increase of a summer-autumn low-water has been caused by the anthropogenic factors.