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Climate-induced and anthropogenic changes of river water inflow into the Russian Arctic seas

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The annual runoff of rivers from the territory of Russia into the Arctic seas is approximately equal 55.6% of the total inflow into the Arctic Ocean. Almost ∼ 84% of this value is provided by 19 large Arctic rivers of Russia. The estimates of their runoff, as of 2015 and for the basin outlet gauges in the lower reaches of rivers, were obtained for the first time. The new data allowed to clarify the values of seasonal runoff and to detail the features of its spatial variability. In multi-year flow fluctuations, the element of uncertainty is greater, and the patterns and trends are not so obvious. Nevertheless, the analysis of cyclicity and trends showed that the annual runoff of most major Arctic rivers has increased by 5–10% mainly due to a trend increasing since the late 1980s and climatic reasons. Most of all the annual runoff has increased near the rivers of the Kola Peninsula and Karelia, the Republic of Yakutia. The "stable behavior" of the runoff or even its decrease was revealed for the Mezen River, the rivers of the Ob North and the Far Northeast. A series of maps reflecting the current distribution of the rivers of the Russian Arctic have been compiled. The increase in the annual runoff on most rivers was provided by an increase in the water runoff in various hydrological seasons. Especially pronounced was the positive dynamics for the runoff of the winter low-water period, to the greatest extent in the mouths of the regulated rivers Ob (by 18%), Yenisei (68%) and Kolyma (169%), and also Lena (46%) that has a large regulated tributary of the Vilyui River. The results of the study show that it is the inter-annual and seasonal regulation of runoff performed by large reservoirs and their filling that is the main factor of anthropogenic disturbances in the amount of runoff and water regime of the Arctic rivers. The paper also assesses the role of full and irretrievable water consumption in the catchment areas of all the Arctic rivers (in the past, present and in the near future), its territorial and industrial structure. Its impact on the inflow of river waters to the Arctic seas is not statistically significant, but it has signs of a crisis situation in some areas of the Arctic catchment area. In total, about 20.6 km3 of river and groundwaters are removed from the basins of the Arctic rivers on the territory of Russia per year. By the years of 2025–2030 this value is planned to be increased to 37.2 km3 per year. This study was supported by Russian Science Foundation grants, Project No. 14-37-00038