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Analysis of the effects of increased river runoff on the Arctic Ocean hydrology using numerical modeling

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The report discusses issues related to the influence of the increased discharge of Arctic rivers on the thermohaline structure of waters outside the Arctic shelf and, in particular, on the variability of Arctic Ocean heat content. The three-dimensional numerical model of the ocean and sea ice SibCIOM (Siberian Coupled Ice-Ocean Model), developed at the Institute of Computational Mathematics and Mathematical Geophysics SB RAS to study the climatic variability of the Arctic Ocean, and the NCEP/NCAR atmospheric reanalysis data are used.

To reveal the sensitivity of the model fields to the intensity of river runoff, numerical experiments assume the inclusion of variations in river discharge with unchanged remaining conditions, starting from 2000. The deviations of the monthly average values in a numerical experiment with increased discharge of individual Arctic rivers from the basic situation based on the monthly average climatic runoff assignment are considered.

An analysis of the numerical results obtained with increased discharge of the major Siberian rivers (Ob, Yenisei, Lena) by 1.3 times showed an increase in the Kara Sea's bottom temperature. This was followed by the warming of the subsurface layer of the waters propagating along the continental slope and increasing the heat content of the upper 200-meter layer of the Eastern Eurasian Basin. The heat preservation entering the deep-water part through the Kara Sea straits was facilitated by an increase in stratification's stability and a decrease of the mixed layer depth by 5-10 m on the continental slope of the Eurasian Basin. A similar process with a time delay (6-7 years) and on a smaller scale is developing on the Amerasian basin's continental slope and the Chukchi Sea shelf.

In the numerical experiment with an increased discharge of the Mackenzie River, deviations in the Beaufort Sea heat and freshwater content appear during the first two years. Still, their values are too small under the river's small discharge compared to the Siberian rivers' discharge.

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