



## **Features and patterns of spatio-temporal variability of water runoff, sediment load and heat flux in the lower reaches of the Lena River and its delta**

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In the last 30–40 years, the water runoff, sediment yield, and heat flux of the Lena River have undergone significant changes due to, mainly, climatic factors. Features of these changes at the marine margin of the Lena River delta are different compared to changes in the delta head area and at the basin outlet station. The reason for this disparity is the transformation of runoff in the large and multi-branched delta. According to the new estimates, the water runoff of the Lena River at the basin outlet station, at the head of the delta, and at the marine margin of the delta equals respectively to 543, 547 and 553 km<sup>3</sup>/year over the period of 1927–2014; the runoff of suspended sediments at the same sections is roughly 22.5, 22.5 and 7.9–13.5 million tons per year. The heat flux is estimated respectively as 16.6•10<sup>15</sup>, 15.6–16.0•10<sup>15</sup> and ~11.75•10<sup>15</sup> kJ/year. The hydrological estimates are influenced considerably by low accuracy and representativeness of hydrometric measurements. For example, the non representativeness of water temperature measurements at the Kyusyur basin outlet station accounts for the differences in the heat flux value approximately by 1000•10<sup>12</sup> kJ/year less.

The water runoff in the lower reaches of the Lena River has increased for all the hydrological seasons in general by 41.7 km<sup>3</sup> per year (in 1980–2014 vs 1935–1979), the sediment runoff – by 5.85 million tons per year (since 1988), the heat flux – by 0.8•10<sup>15</sup> kJ/year. An increase in water temperature has been noted as well. The main increase in runoff has been observed since the end of the 1980s. The water use and creation of two Vilyuy reservoirs had almost no impact on the water resources of the river ( $\Delta W_{he} \approx -0.35$  km<sup>3</sup>/year during 2001–2013), but have violated the natural conditions of winter low water. The influence of economic activity on other components of the river runoff has not been established.

At the Stolb Island, i.e. in the main Lena River delta branch node, the percentage of water runoff of the Bykovskaya branch was about 25.5% in 1990–2007 (of the sums of runoff volumes in the sources of the main channels), the Trofimovskaya branch – ~60.9%, the Tumatskaya branch – ~ 6.7%, the Olenekskaya branch – ~6.9%. Within a year, these ratios change. With high Q, huge ice jams and high water levels part of runoff passes across the floodplain and its channels, i.e. bypasses the main hydrometric sections. The suspended sediments are distributed in the following proportions: the Bykovskaya branch – 17.2%, the Trofimovskaya branch – 70%, the Tumatskaya branch – 6.7%, the Oleneskaya branch – 6.1%. The runoff from Stolb Island to the marine margin of the Lena River delta is distributed between ~6 thousand streams and is rather unstable due to the fluviomorphological processes. Standard methods of measurements are inapplicable in these conditions. The research has been performed at the expense of RSF Grant 14-37-00038.