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Lake level dynamics of the Terekhol Lake (Upper Yenisei River Basin, Russia): reconstructions by the dendrochronological and remote sensing methods

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The Terekhol Lake is located in Russia, Tuva republic, Southern Siberia (50°36'54" N, 97°23'07"E) in the upper catchment of the Yenisei River. It occupies the bottom of Terekhol Basin of Sangilen Mountains. There is a territory with extreme continental climate (severe and little snow winter, dry and hot summer, mean annual temperature -6.7°, average annual precipitation 323 mm).
The climate and hydrological regime of the lake were studied by the methods of dendrochronology and remote sensing. The reconstructions of lake level during the last 250 years were realized. The studies are based on follow materials: cores and disks of larch (Larix sibirica Ledeb.) sampled in sites located on two levels of lake terraces influenced by groundwater and in the sites on the watershed area without such influence; CRU 2.1. climate data for 1901-2002; high resolution imageries for 1957 (aerial 1:25 000), 1970 (Corona KH-4B), 2007 (QuickBird).
The obtained results show that dynamics of tree ring growth in the Terekhol depression depends on variations in precipitation. According to our data the precipitation in the last 100 years demonstrated decadal-scale variability: increased humidity in the middle 20th century with the highest lake levels during 1947-1954 (30-40 cm higher then today), and sharp drop of moistening since 1970. Decreasing of the lake level in 1970 was a reason of permafrost process activation, degradation of permafrost relief and drying of trees on the first lake terrace. The last 200 years are characterized by repeated oscillation of moistening with different duration and amplitude. In periods with high humidity (years: 1790, 1816, 1830, 1875, 1950) a rise of the lake level by 30-100 cm was reconstructed that accomplished by death of trees on the first terrace and improvement of tree growth conditions on the second terrace. In periods with low precipitation (years: 1773, 1775, 1807, 1834, 1865, 1893, 1907, 1970) the lake level were sank and was close to its present level or lower, well conditions for tree growth on the first terrace were developed and drying of trees on the second terrace occurred. Thus, the changes of the moisture regime in the Terekhol basin (286 km2) lead to fluctuations in the lake level about 30-40 cm in 2-3 years.

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