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Quantitative estimates of Mid- to late Holocene Climate Variability in northeastern Siberia inferred from chironomids in lake sediments

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Yakutia (Russia, northeastern part of Eurasia) represents one of Earths most extreme climatic settings in the world with deep-reaching frozen ground and a semiarid continental climate with highest seasonal temperature contrasts in the northern hemisphere. The amplitude of temperature variations around the year sometimes exceeds 100oC. There are few examples of quantitative palaeoecological studies in Siberia and these data have to be tested by quantitative studies from other sites in this region, inferred from different proxies and using regional calibration datasets and temperature models that are still lacking. Chironomid midges (Insecta, Diptera, Chironomidae) have been widely used to reconstruct past climate variability in many areas of Western Europe and North America. A chironomid-mean July air temperature inference model has been developed, based on a modern calibration set of 200 lakes sampled along a transect from 110° to 159° E and 61° to73° N in northern Russia. The inference model was applied to sediment cores from 2 lakes in the Central Yakutia in order to reconstruct past July air temperatures. The lacustrine records span mid- to late Holocene. The downcore variability in the chironomid assemblages and the composition of organic matter give evidence of climate-driven and interrelated changes in biological productivity, lacustrine trophic states, and lake-level fluctuations. Three phases of the climate development in Central Yakutia can be derived from the geochemical composition of the lake cores and according to the inferred from chironomid assemblages mean July air ToC. Content of organic matters reached maximal values in the period between 7000-4500 yBP. Sedimentation rate is especially high, numerous molluscs shells are found in sediments. All this along with the reconstructed air temperature confirmed that Mid Holocene optimum in Central Yakutia took place in this period with the maximal temperatures up to 4oC above present day ToC. Strong faunistic changes take place after 4500 yBP. Temperature reconstruction has shown that around 4500 ka BP air temperature went down up to 2oC below modern temperature. These observations confirm end of Holocene climate optimum at this time. The lake status record reveals a long-term trend towards lake-level lowering in the course of climate deterioration after 4.2 cal. ka BP and reduced evaporation as well as progressive sediment infill. This long-term trend is overprinted by short-term fluctuations at centennial time scales with high lake levels and decreased biological productivity during cool climate spells with reduced evaporation, as also observed in modern thermokarst lakes of Central Yakutia.