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New data on the morphology of Kipyashchee lake (Golovnin volcano, Kunashir Isl., Kuril Islands) based on the 2023 study results

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Abstract. Golovnin volcano (Kunashir Island, Kuril Islands) is a caldera that arose approximately 39 thousand years ago, in which two volcanic lakes are currently located: Goryachee caldera lake and Kipyashchee crater lake. The morphology of the terrestrial part of the caldera has been studied sufficiently, whereas its underwater relief – the relief of lake basins – has been studied by several scientific teams only sporadically. This information was rather simplified, which was necessary for such tasks as assessing the potential of sulfur-bearing areas. Data on morphometric parameters for different years were not compared. Since the mid-2000s, such study has been carried out by the team of the Laboratory of volcanology and volcanic hazard of the IMGG FEB RAS, having completed a series of studies on the lakes of the caldera until 2023. In these studies, for the first time a unique high-precision digital material was obtained using a sonar, describing in detail the morphometric parameters of the basins. The aim of the study in 2023 was to establish the current structure of the Kipyashchee lake basin and to conduct a preliminary assessment of changes in the morphology of the basin over the observation period since 2005. In this paper, we analyzed current parameters and changes in the morphology of the Kipyashchee lake basin, as well as the events that occurred during the period of the observations since 2005, and compared these results with the studies of other authors. A high-precision bathymetric model of the Kipyashchee lake is presented for the first time with an isobath spacing of 0.5 m, built on the basis of 23 sonar profiles with satellite reference. As of September 2023, the maximum length of the lake was 330 m, the width was 190 m, the length of the coastline was 870 m, the mirror area was 0.0462 km^2, and the maximum depth was 24 m. Our previous studies, carried out two decades ago, showed a maximum depth of 16 m, and, according to the measurements of our colleagues from Kamchatka in 2020–2021, the depth of 25 m was recorded. Thus, during the period of observations since 2005, there were changes in the depth of at least 50 % in the Kipyashchee lake crater, which characterizes the reservoir as one of the most dynamic in the region.

Keywords:
Golovnin volcano, Kipyashchee lake, sonar, morphology, bathymetric survey, gas hydrotherms

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