

Thermal regime of a subarctic deep lake and its response to climate change: the non-freezing effect on the ecosystem

*Kazuhiisa A. Chikita¹, Hideo Oyagi², Shiori Yamane⁶, Tadao Aiyama³, Toshihisa Itaya⁴, Misao Okada⁵

1. Department of Earth and Planetary Sciences, Faculty of Science, Hokkaido University, 2. College of Humanities and Sciences, Nihon University, 3. The Fukuda Hydrology Center, Inc., 4. Shin Engineering Consultant, Inc., 5. Suiko-Research, Inc., 6. Department of Earth and Planetary Sciences, School of Science, Hokkaido University

According to the Köppen-Geiger climate classification, the Hokkaido Island, Japan, belongs to the southernmost subarctic area, but lakes in Hokkaido belongs to dimictic, temperate ones. This research focuses on non-freezing of a temperate deep lake, Lake Kuttara, Hokkaido, and its effect on the ecosystem (Fig. 1). Using 3-yr water-temperature and hydrometeorological data, we got the intra- and interannual changes of the heat storage. As a result, it is seen that, if accumulated heat storage change is more than -500 W/m^2 , the lake could be unfrozen. The sensitivity analysis to main meteorological factors indicates that an increase in air temperature is most effective to an increase in the heat storage change, and that the lake could be eternally unfrozen in a few decades.

Keywords: non-freezing, heat storage change, climate change, deep lake

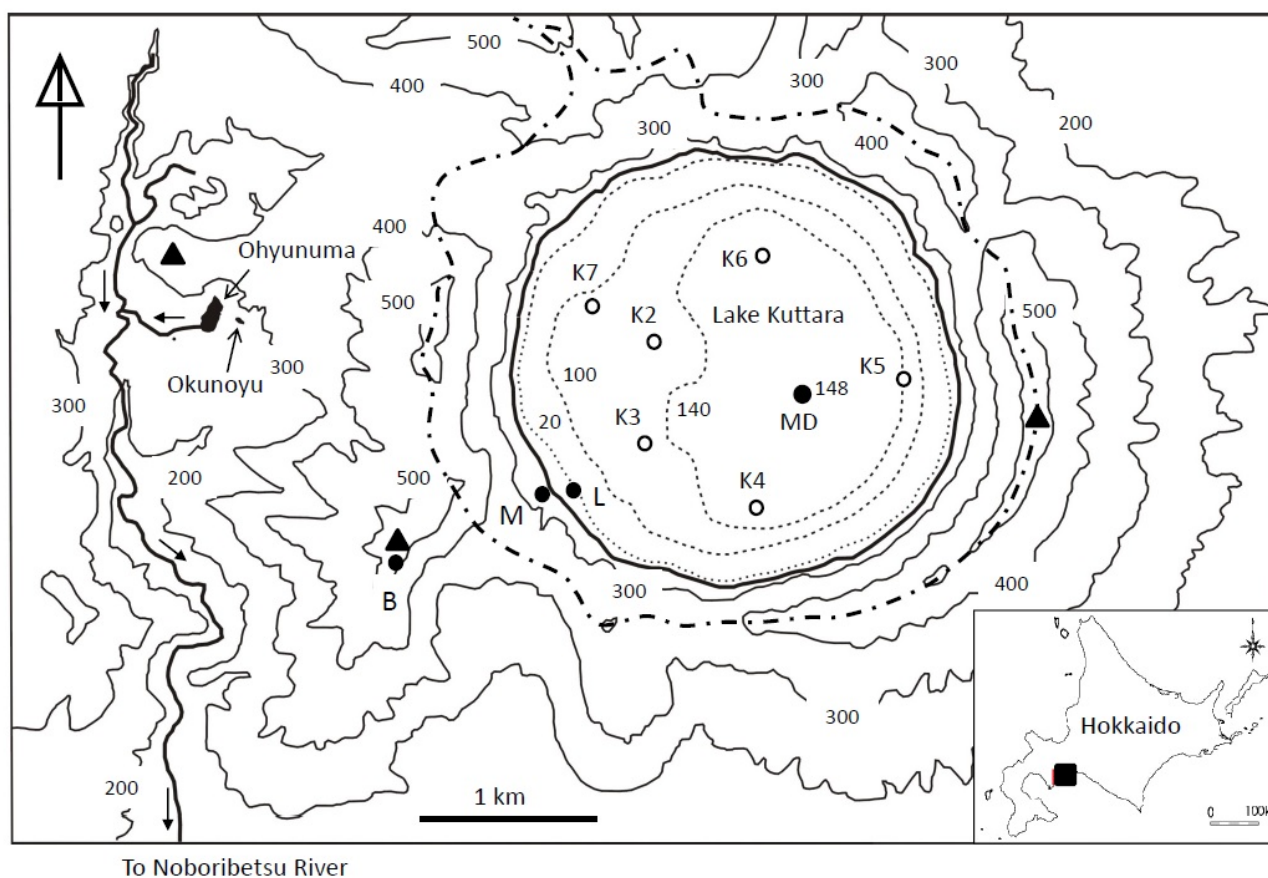


Fig. 1 Location of Lake Kuttara and observation sites on the bathymetry (water depth in m by dotted lines). The dashed dotted line shows a water divide of the lake.