

Secular change of water temperature in hypolimnion of Lake Tazawa

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Lake Tazawa, located in the west of the mountainous backbone of Northeast Japan, is the deepest lake (max: 423 m) and has one of the largest cryptodepression in Japan. Although mountains surround the lake, there are only few natural perennial streams that flow into the lake in the southern part of the catchment. In addition, there is no natural perennial surface discharge at present. Although limnological and hydrological studies have discussed the water cycle in this lake since 1920s (e.g., Yoshimura, 1937; Tanaka, 1925), the mechanism of the water cycle has not been clarified, because of insufficiency of year-round dataset including both epilimnion and hypolimnion. On the other hand, water of an acid river, called Tamagawa River, has been conveyed to the lake for dilution of low pH water and generation of electricity since 1940. As the result, deteriorations of water quality (e.g., decline of pH, increase of concentrations of metallic elements and deterioration of clarity) have occurred in all depths. As a countermeasure, neutralization of the acid river water has been carried out since 1991. These anthropogenic environmental changes are considered to have changed the water cycle of the lake. In addition, climate change including global warming also may have changed the water cycle by warming of epilimnion of the lake. This study aims to clarify the changes of the water cycle by focusing on water temperature. We have repeatedly conducted logging of water temperature profile in the center of the lake using thermistor logger (resolution: 0.001 degree Celsius, accuracy: ± 0.002 degree Celsius) since May, 2015. This presentation will show the results in hypolimnion.

In the depth of 400m, water temperature increased 0.03 degree Celsius between May, 2015 and July, 2017. Water temperature in this depth also has increased 0.42 degree Celsius since August, 1937 to July, 2017 (approximately 80 years). Especially, water temperature is considered to increase around 1991, that is, around starting of neutralization countermeasures. These results suggest that the water cycle of the lake has been changed by the anthropogenic water environment changes; A: before 1940 (before conveyance of the acid river water; natural condition), B: 1940 to 1991 (acidification and water quality change of the lake water), C: after 1991 (starting of neutralization countermeasure).

Keywords: Lake Tazawa, water cycle, acidification, climate change, hypolimnion