

Lake water distribution derived from surface water oxygen and hydrogen isotopes around Fuji Five Lakes

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The process of water flowing into lakes through precipitation, groundwater, and river water varies depending on the region and season, and it is important to clarify the details in order to know the state of the lake in the future. In previous studies, oxygen and hydrogen isotope ratios have been widely used as effective tools for estimating the origin of precipitation and groundwater.

The results of oxygen and hydrogen isotope ratios in precipitation and groundwater have been reported around Mt. Fuji. However, it is difficult to estimate the groundwater catchment area in the northern part of Mt. Fuji where Fuji Five Lakes are located due to the lack of oxygen and hydrogen isotope data compared to the southern and eastern parts. Results of oxygen and hydrogen isotope ratios in precipitation and groundwater have been reported around Mt. Fuji. However, it is only reported that the oxygen isotope / hydrogen isotope ratio is lighter in the northern ridge of Mt. Fuji, where Fuji Five Lakes are located, than in the southern and eastern ridges.

For example, in Lake Motosu, continuous surveys of surface water vanadium concentration, water temperature and water quality surveys in summer and winter, and vertical surveys of water temperature and water quality throughout the year, show that precipitation accounts for a large part of the water balance. However, since the northern foot of Mt. Fuji was formed by a lava flow, it is difficult to identify the catchment area and was necessary to consider the groundwater flow between Lakes Motosu, Shoji, and Sai.

In the hydrological survey and lake bottom survey of Lake Kawaguchi, at the observation point about 100 m east of Unoshima located in the center of the lake, disturbances in the stratified structure of water temperature and electrical conductivity were observed, and from the bottom of the lake at a depth of about 8 m, the outflow of water with different water quality was newly confirmed.

As described above, continuous accumulation of data is small in the Fuji Five Lakes area, and since the surroundings of Fuji Five Lakes are complex topography with lava, estimation of the groundwater catchment area only from the results of oxygen and hydrogen isotope ratios was difficult.

In this study, the oxygen and hydrogen isotopes of the lake water of Fuji Five Lakes are continuously measured at monthly intervals. Therefore, the surface water of Fuji Five Lakes was collected periodically at monthly intervals from June 2018, and the oxygen and hydrogen isotope ratios of the lake water were measured. A wavelength scan cavity ring-down spectrometer of the Institute of Atmosphere and Ocean Research, The University of Tokyo was used for the measurement. In addition, the results of the groundwater measurement and the water balance study were combined to give a comprehensive discussion, and seasonal changes in the oxygen isotope ratio of Fuji Five Lakes and the groundwater catchment area of Fuji Five Lakes were estimated.

Lakes Kawaguchi, Sai and Yamanaka tended to have higher isotopic ratios during the summer. This result is consistent with the strong effect of evaporation in summer. On the other hand, isotope ratio in Lake Motosu became lighter in summer. Since Lake Motosu is located near the Pacific Ocean, there is a possibility that precipitation with different travel routes is supplied in summer.

In addition to the above results, the groundwater catchment area of Fuji Five Lakes is estimated by comprehensively considering the measurement results of groundwater around the lake and the results of water balance studies.

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