

# Long-Term monthly measurements of dissolved inorganic radiocarbon in water around Fuji Five Lakes for understanding seasonal hydrological variation

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The process of water flowing into lakes through precipitation, groundwater, and rivers varies from region to region and between seasons. In order to understand the future hydrological state of lakes, it is important to clarify the details of the hydrological cycle in the long term. Around the Fuji Five Lakes, located in the northern region of Mount Fuji, geophysical explorations and groundwater surveys were conducted from the mid-1940s to 1960s to explore [T.M.1] underground resources. Lake Motosu is a volcanic dammed lake at the northwestern foot of Mount Fuji. The lake has only temporal inflow and outflow rivers, and lake water characteristics are generally defined by a combination of precipitation and groundwater inflow. Previous surveys on water quality in Lake Motosu, including vanadium concentration and water temperature in surface water during summer and winter, and the vertical distribution of water temperature and water quality throughout the year revealed that precipitation is the dominant factor in the water quality of the lake. It is, therefore, possible to quantitatively estimate the water transport pathways, including the carbon transport process in the hydrosphere. The lake water of Lake Kawaguchi was also estimated to be primarily derived from precipitation and groundwater.

In this study, we investigated the water pathways to Lakes Motosu and Kawaguchi by measuring radiocarbon concentration ( $\Delta^{14}\text{C}$ ) in dissolved inorganic carbon (DIC), and oxygen and hydrogen ( $\delta^{18}\text{O}$  and  $\delta\text{D}$ ) stable isotopes of water in precipitation, groundwater, and lake water from 2018 to 2021, as well as the spring water at the lake bottom. They were measured using a single-stage accelerator mass spectrometer and a wavelength scanning cavity ring-down spectrometer at the Atmosphere and Ocean Research Institute, the University of Tokyo. The DIC  $\Delta^{14}\text{C}$  of surface water in Lake Motosu was found to increase during winter with the highest value in January. In contrast, the  $\Delta^{14}\text{C}$  values became lower in summer. Seasonal variations of  $\Delta^{14}\text{C}$  were also observed in both 2019 and 2020, confirming that  $\Delta^{14}\text{C}$  in Lake Kawaguchi decreases from summer to fall and increases during winter. Heavy precipitation exceeding 300 mm in a few days because of Typhoon#19 in October 2019 significantly increased  $\Delta^{14}\text{C}$  in the Lake Kawaguchi for one month and it could be caused by temporal changes in the surface water pathway. The  $^{14}\text{C}$  box model demonstrated that  $^{14}\text{C}$  could semi-quantitatively reflect the groundwater flow in the lake.

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