

Evaluation of river discharge due to heavy rain using water level data in a large lake

Maho Iwaki^{1*}, Michio Kumagai², Katsuya Nishi³, Chunmeng Jiao⁴

¹Graduate School of Human and Environmental Studies, University of Kyoto, ²Ritsumeikan University, ³Biological Hydrodynamics Research, ⁴Lake Biwa Environmental Research Institute

We aimed to evaluate the river discharge due to heavy rain in Lake Biwa, the largest lake of Japan. For this purpose, we analyzed high-resolution water level data measured at the lake. We then calculated the response of the water level of Lake Biwa to the river inflows. The fluctuations in the water level of Lake Biwa were investigated during the period 2010-2012. These fluctuations were attributed to precipitation in a catchment area in the southwest region of Shiga Prefecture, Japan; a river flowed through this catchment area into Lake Biwa. A water level instrument with a resolution of 1 mm was used, and the sampling interval for the data logger was 2 min. Given that many factors control the water level in Lake Biwa, we performed multiple time scale analysis. This allowed us to separate the effect of inherent oscillations on the water level of the lake.

The change in the water level of the lake is balanced by inflow and outflow. The factors affecting the water level in the lake include seiches, wind, waves, precipitation (on the surface of a lake, via a drainage basin, and via groundwater), evaporation, and outflow, which have different spatiotemporal scales. Surface seiches can lead to short-term changes in the water level, whereas precipitation results in the greatest changes in the water level. Precipitation that directly occurs over a lake results in an increase in the water level, whereas precipitation over the catchment area flows into the lake through a river or as groundwater. However, the amount by which the water level of a lake can increase because of rapid precipitation has not been discussed in detail thus far. Hence, we evaluated the contribution of precipitation flowing into Lake Biwa through a river; for this purpose, we used high-resolution water level data of Lake Biwa. We then calculated the response of the water level of Lake Biwa to the river inflow. As a result, if the amount of riverine precipitation increases, and particularly if the precipitation exceeds 100 mm, it turned out that the volume of riverine input increases 40 to 60 % of precipitation sharply that flow into Lake Biwa.

Keywords: Lake Biwa, Water Level, contribute ratio of river flow, precipitation