

How the precipitation to the catchment effect on the lake water level using depth meter moored in north Lake Biwa

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Lake water levels are balanced by short-term events, such as direct rainfall, seiches, river inflow due to precipitation in the catchment land area and subsurface flow, evaporation (both at the lake surface and in its catchment area), and groundwater inflow and outflow. Each factor controlling the water level of a lake has a unique temporal and spatial scale. To understand complex lake level changes, it is better to have a spectral analysis that can separate the waves into several periods, and to determine on which time scale these processes are dominant. The shape of the response function reflects the lake system itself, such information will further be helpful to lake resource managers. If we could know the effect of rapid response of the water level, it makes possible to determine the precipitation retention time at the surface (above the impermeable layer) of a catchment area and how long it takes precipitation to reach the lake. By calculating the impulse response function using the data obtained by the depth meter installed in the mooring system in Lake Biwa from 2017 to 2018, we discussed how long it takes rainfall to reach the lake through the river. We observed water depth (10-min intervals) in the northern basin of Lake Biwa in August 2017 to October 2018, we calculate the response functions the rainfall to lake level during a severe heavy rainfall event. We could separate the delay time, direct rainfall into the lake and rapid river inflow. A response of 6-8 hours has been confirmed in analysis of water level by FFT (Fast Fourier Transform) (Iwaki et al. 2014), since the first mode of seiche is about 4 hours, then, the cause is hypothesized to be river inflow, however it was unclear why the response appeared clearly. Then we try to identify the delay time of rapid response (< 12 h) after rainfall. We could identify that the delay time of 6-8 hours may be due to the inflow by approximately 20-25 km rivers found in the North Lake Biwa. The proposed method can be used to evaluate the impacts of rivers on the lake, and the results can help to clarify the lake metabolism and lake managements.

Keywords: lake, lake level response, frequency response function