

Re-consideration of discharge rate of spring water in Lake Ezu, Kumamoto

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In Kumamoto area, 100% of tap water is sourced from abundant groundwater. Recently, there is a great fear of groundwater level decreasing. To estimate discharge rate of spring water in Lake Ezu, the flow rate at 13 sites has been observed every month since December 1991. In previous studies, the total discharge rate of spring water was calculated by flow rates only at the most downstream, the most upper-stream, and incoming streams. In this study, total discharge rate from December 1991 to December 2014 was re-considered as a sum of three zones, that is upper-stream area, Kami-Ezu Lake, and Shimo-Ezu lake. When the discharge rate in each zone became negative, the case 1 where calculation was carried out with minus and the case 2 where it assumed to 0m³/day were compared. As a result, total discharge rate gradually declined from about 450,000m³/day in 1992 to about 360,000m³/day (case 1) and to about 410,000m³/day (case 2) in 2005. In July 2006, total discharge rate rapidly increased with heavy rainfall. After that, it had fluctuated about 400,000 to 500,000m³/day in both cases. The discharge rate of Shimo-Ezu Lake sometimes became negative after 2003, and that averaged after July 2006 in case 2 was about 90,000m³/day more than the case 1. As a result of comparing seasonal variability of discharge rate, monthly mean values of total and Shimo-Ezu Lake are low in April-May and high in October-November. However, monthly mean values of upper-stream area and Kami-Ezu Lake show no significant seasonal fluctuation. Monthly mean values of Shimo-Ezu Lake in August averaged after 2006 was about -14,000m³/day in case 1 and about 32,000 m³/day in case 2. Since negative value is not suitable to represent seasonal fluctuation, case 2 is proper to represent the discharge rate of spring water.

Keywords: spring water, Lake Ezu, long-term trend, seasonal variability