

## Interaction properties between river and groundwater with assessment of oxygen isotope ratio and nutrient concentration

MARUYAMA, Yutaka<sup>1\*</sup> ; ONODERA, Shin-ichi<sup>1</sup> ; SAITO, Mitsuyo<sup>2</sup> ; KITAOKA, Koichi<sup>3</sup>

<sup>1</sup>Graduate School of Integrated Arts and Sciences, Hiroshima University, <sup>2</sup>Graduate School of Environmental and Life Science, Okayama University, <sup>3</sup>Department of Applied Science, Okayama University of Science

In the alluvial fan, there are many palaeo-channels which are composed of more permeable media like gravel and sand, and many springs and wells on those have been useful for human life as well as ecosystem. These type of the springs have the different waveforms of the seasonal thermal variation from those of the river or air which is the thermal source. In detail, the phase shifting and amplitude declining are confirmed in springs. In this research, we examine to confirm the thermal waveforms in the river and springs and to estimate the horizontal bypass flow velocities in palaeo-channels around the river in the alluvial fan. The study areas are Asahi river springs in Okayama prefecture of western Japan. At the springs of Asahi River, the temperature data was collected 1 week interval. The temperature data of Asahi River springs was analyzed, assuming the subsurface water flow only through the bypath as the one-dimensional advection-diffusion equation and heat flux from the ground surface depends on the temperature gradient between the aquifer and the upper layer. The analytical solution of this equation was verified by parameter fittings with the data.

The Darcy velocity of subsurface flow was estimated about 1.3 m/day. The distribution of one-dimensional subsurface temperature in the alluvial fan was simulated that thermal conductive flux from the river exponentially decreased. The flux was mainly controlled by the advection process. In addition, the heat flux from the ground surface varied spatially from the rivers depends on the variation of the heat gradient. Especially, the flux was about 0 at several sites where heat gradient decreased.

Keywords: Surface water-groundwater interaction, Oxygen-18 isotope, Nutrient concentration, Temperature, Alluvial fan