

The Role of River Water, Precipitation and Irrigation Water on Groundwater Recharge in Kanuma Region, Tochigi Prefecture, Japan

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The objective of this study is to investigate groundwater recharge and the interaction between groundwater and surface water in an alluvial area, Tochigi Prefecture, North Kanto Plain, Japan. We measured water quality and stable isotopic composition of deuterium and oxygen 18 in groundwater, river water, irrigation water and precipitation. Also the river discharge rate was observed. The water sampling was performed from February 2007 to March 2008 in Kanuma region, Kurokawa River watershed. The relative contribution of different sources to the groundwater recharge was estimated from stable isotopic composition of deuterium and oxygen 18 using End Member Mixing Analysis (EMMA). Quantity of interaction between groundwater and surface water was estimated using stable isotopic composition of oxygen 18 and chloride concentration.

The observed results showed that source of the groundwater recharge is mainly river water in Kanuma region. During the irrigated season, the water ponded on the paddy field and precipitation also play an important role in groundwater recharge. On the other hand, river water accounts more than 90 percent of groundwater recharge in the most of wells, during no-irrigated season. The wells showing different solute concentrations also originates from river water, though some ions might have been added by fertilizer. Irrigation water in the paddy field showed low ion concentration; however, groundwater recharged by irrigation water showed a higher ion concentration in the summer than the other season.

Quantity of interaction between groundwater and river water was estimated by a simple mass balance method using stable isotopic composition of oxygen 18 and Cl^- as tracers. Discharge rate of groundwater into river and groundwater recharge rate by river was estimated to be approximately 7 percent to 20 percent of river discharge along the distance of 100 m in the Kurokawa River.