

Evaluation of groundwater and surface water interaction considering the natural and anthropogenic events in a small watershed in South Korea

SEONG-SUN LEE, SUH-HO LEE, HA-YEONG SEOK, IN-
HEE CHO, HYEJI KIM AND KANG-KUN LEE

Seoul National University

To consider the effect of natural (rainfall) and anthropogenic events (weir operation) that can reflect environmental changes at the sites in evaluating the interconnectivity of groundwater and surface water in a small watershed, multi-lateral approach was applied. This study was conducted in the Hyogyo Stream and Pyengjeong Stream in South Korea, where the stream is affected by multiple water sources (agricultural water, reservoirs, rainfall). For cross-disciplinary collaborations, geophysical methods, natural tracer methods, baseflow estimation methods were applied. The results of 3D ER survey that conducted to schematize spatial variations in hyporheic zone showed that groundwater discharge points on some specific point (streambed or around the stream bank) are well matched with results obtained from heat tracer methods. Natural tracers like hydrogeochemical, isotopic, and heat tracers are applied to identify interaction patterns and quantify GW-SW exchange rates such as vertical hyporheic flux. Hydrogeochemical and isotopic tracers were applied to identify the end-members of streamflow and determine the comprehensive end-members that can estimate reasonable baseflow of the study site. End-member mixing analysis (EMMA) was applied to characterize the contributors to streamflow. The Bayesian mixing model was applied to quantify GW and SW mixing using three end members selected by seasonal data of Si and $\delta^{18}\text{O}$. Tracer-based and non-tracer based baseflow separation method was applied to estimate baseflow. Heat tracers in this study were used to estimate the vertical hyporheic flux. Based on the temperature data, analytical (VFLUX) and numerical models (LPMLen, and 1DTempPro) were applied to estimate the GW-SW exchange rates. The results were compared to hydrometric results. From the results of vertical profiling, some specific groundwater discharge points on the streambed were identified. Consequently, estimation and interpretation of GW-SW interaction In a small watershed considering the events can be conducted through the cross validation of multilateral tracing methods. This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2022R1A5A1085103) and a grant from the National Institute of Environmental Research (NIER), funded by the Ministry of Environment (ME) of the Republic