Characterization of catchment water dynamics using tracer-aided model for Kumamoto region in southern Japan

A.T.M. Sakiur Rahman[1], Takahiro Hosono[2], Yasuhiro Tawara[3], Dennis Boateng[1], and Jun Shimada[2]
[1] *Department of Earth and Environmental Science, Faculty of Science, Kumamoto University*
[2] *Priority Organization for Innovation and Excellence, Kumamoto University*
[3] *Geosphere Environmental Technology Corporation*

E-mail: shakigeo@gmail.com

Keywords: Regional flow simulation, groundwater age, multiple-tracer aided model, Kumamoto

Abstract

Integrated watershed modeling techniques are being applied to examine the surface and subsurface interactions in recent years. Generally, modeling approaches heavily rely on the best fit of the hydrograph which cannot alone describe entire catchment water dynamics. For holistic understanding of hydrological processes, it is necessary to incorporate and simultaneously simulate tracers which can provide important inferences about water ages, flow paths and origin. Hence, this study incorporated multiple tracers like tritium (^{3}H), Krypton-85 (^{85}Kr), and groundwater temperature in model calibrations and seamlessly simulated tracers coupled with surface and subsurface flows using a fully distributed physically based modeling approach for details characterizations of Kumamoto water regimes in southern Japan. The first model developed using the regular hydrometric parameters could not characterize isotopic compositions and groundwater temperature, though it showed acceptable model performance for simulating surface water and groundwater hydrographs for several observation stations located in the area. The second model calibrated by integrating tracers with regular parameters well characterized hydrographs of surface water, groundwater as well as isotopic compositions and groundwater temperature. Hence, tracer-aided model was used for simulating groundwater storage, flow paths and groundwater age which showed a close agreement with estimation of water ages using isotopic approaches in previous studies. The findings of the novel approach proposed in this study prove the potential in the use of multiple tracers for details visualizations of subsurface water dynamics. It is expected that the learning framework presented in this study will be beneficial for field hydrologists and modelers to make joint efforts to build robust models for hydrological processes.