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Application of combined SWAT-MODFLOW model to the Musim River Basin in Korea

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The use of watershed models has been increasing in response to growing demands for sustainable water resources and improved water quality. In this study, an integrated model of the semi-distributed watershed model, SWAT and the fully-distributed ground-water model, MODFLOW was presented to examine watershed-scale hydrologic processes. Comprehensive simulations for the Musim River basin in Korea were carried out to estimate the appropriate model parameters and to assess the applicability of the SWAT-MODFLOW. Groundwater levels in the interest area close to the stream have dynamics similar to stream flow, whereas levels further upslope responded to precipitation with a delay. To represent these features, it is needed to account for the time delay in aquifer recharge once the water exits the soil profile. In SWAT-MODFLOW, an exponential decay weighting function is utilized to represent the recharge to the aquifer on a given day. The function has the parameter related to the delay time which was estimated, in the present work, by simulating recharge using different values for delay time and by comparing the simulated groundwater table with observed one. Simulation results indicate that the model successfully predicts the main characteristics of the surface and groundwater flow systems. The effects of various groundwater withdrawal scenarios on the runoff as well as the dynamics of groundwater system were highlighted.

Keywords : watershed model, SWAT, MODFLOW, recharge, groundwater withdrawal

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