



Using groundwater modeling as a constraint in the study of environmental isotopes

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Environmental Isotopes have been one of the most important tracers to determine the sources of recharged groundwater, especially in mountain aquifers. However, the interpretation from the results of environmental isotopes is difficult to be verified and has rarely been done. In this study, a numerical modeling, MODFLOW and related packages, was performed for verifying the model derived from the results of oxygen and hydrogen isotopes.

Puli Basin is an extensional basin in the mountain area in the central Taiwan. The basin was filled with massive conglomerate for over 500 meters and there are two major rivers that flow across the north and south basin, respectively. According to the results of oxygen and hydrogen isotopes in the previous studies, it was concluded that over 90% of the groundwater in Puli Basin was mainly recharged by the south river system. To verify this derivation, in this study, the groundwater flow model was firstly established by using MODFLOW. It is found that the groundwater in the basin was indeed mainly recharged by the surface river system instead of the inflow from the underneath bedrock of the basin. Even though the numerical model was performed under a wide range of model parameters, the modeling results do not support the possibility that the south river system is able to provide over 90% of the recharge. According to the results of the numerical modeling, the south river system could account for about 45% of the total recharge; the contribution from the north river is about 25%; and, the others could be recharged in the downstream area after two river systems emerge in the west of the basin. In addition, there are some packages can simulate to trace environmental isotopes as particles in this study. The environmental isotopic distribution in the groundwater of Puli Basin can be calculated. Subsequently, the resultant distribution can be a better constrain to estimate the recharge sources for the future studies about environmental isotopes.