



Integrated Approach for Assessing the Characteristic of Groundwater Recharge in Basin Scale

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An integrated approach is presented for the assessment the characteristic of groundwater recharge using remote sensing (RS), geographic information system (GIS), stable-base-flow analysis (SBF), and environmental stable isotopes techniques considering Chih-Pen Creek basin, southeast Taiwan as a study area. First, the RS and GIS techniques are used to integrate five contributing factors: lithology, land cover/land use, lineaments, drainage, and slope. The weights of factors contributing to the groundwater recharge are derived using aerial photos, geological maps, a land use database, and field verification. Second the SBF is established to estimate the groundwater recharge in basin scale. The concept of the SBF is to use the base-flow separation from the total streamflow discharge to obtain a measure of groundwater recharge. Finally, stable isotopes of oxygen and hydrogen are used to evaluate the sources of groundwater and seasonal contributions of precipitation to groundwater recharge in basin.

The resultant map of the groundwater potential zone demonstrates that the most effective groundwater recharge potential zone is located downstream. In study region, the gravelly stratum and agricultural land have high infiltration ability. In contrast, the least effective recharge potential area is in upstream regions due to the low infiltration of limestone. From SBF estimation, the average of the groundwater recharge over twenty-eight years (1980-2007) in basin is 101 billion tons/year. Based on stable isotopic characteristics, the results show that 79% of the groundwater in study basin is derived from river water of the mountain watershed and 21% is from the rain that falls on the basin. Comparison of deuterium excess of precipitation and groundwater indicates the groundwater consist of 76% wet season precipitation and 24% dry season precipitation, representing a distinct seasonal variation of groundwater recharge in study basin.

Keywords: GIS, Stable base-flow, Stable isotopes, Groundwater recharge