

Isotope Techniques Applied for Understanding of Catchment Water Balance — A Case Study for the Han River Basin, Korea

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The Han River basin, including its tributaries with diverse spatial scales, is the core research site of HydroKorea to understand water cycles in typical forest watersheds of Korean Peninsula. Stable and radioactive isotope analyses for various components of water cycle are being conducted as a part of HydroKorea research to derive catchment and footprint scale evaporation flux, to constrain mean residence time (MRT) of water, and to elucidate the subsurface water flow. Tritium (³H) concentration of precipitation and river water is being determined to estimate MRT of water in the Han River basin and its tributaries. The calculated MRT will be used to set a time constraint for the derived water cycle component. Hydrogen and oxygen isotope composition of precipitation and river water is used to derive catchment scale evaporation flux, and stable isotope analysis of water vapor is being conducted to partition evapotranspiration flux (measured by eddy covariance technique) into evaporation and transpiration components at tower scale. Temporal and spatial variation of stable isotope composition of stem water is an effective indicator of subsurface water flow. Results from isotope study, together with other ecohydrological measurements, will establish a quality database to be used for validation of various ecohydrological models and satellite-based approaches to improve their applicability and predictability in water cycle studies at diverse temporal and spatial scales. A preliminary result from isotope study indicates that the evaporation component in the Han River basin and its tributaries is quantitatively insignificant. Supporting evidences should be found from hydrological data in the area such as causal relationships between precipitation and soil moisture contents, groundwater table, river discharge. Model-derived evaporation flux in the area must also be reconciled with the isotope based estimate. An interesting finding from this isotope study is that the stable isotope composition of precipitation and river water and the relation between them in the Han River basin have been nearly constant during last ~10 years. This indicates that the main driver of evapotranspiration has not changed despite noticeable changes in meteorological and land cover characteristics during the last decade. Acknowledgment: This study is supported by a grant (Code: 1-8-2) from Sustainable Water Resources Research Center of 21st Century Frontier Research Program. Key Words: isotopes, the Han River basin, water balance, evaporation, HydroKorea