Estimation and Classification of Flow Regimes for South Korean Streams and Rivers

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Abstract

The information of flow regimes continues to be norm in water resource and watershed management, in that stream flow regime is a crucial factor influencing water quality, geomorphology, and the community structure of stream biota. The objectives of this study were to estimate Korean stream flows from landscape variables, classify stream flow gages using hydraulic characteristics, and then apply these methods to ungaged biological monitoring sites for effective ecological assessment. Here I used a linear modeling approach (MLR, PCA, and PCR) to describe and predict seasonal flow statistics from landscape variables. MLR models were successfully built for a range of exceedance discharges and time frames (annual, January, May, July, and October), and these models explained a high degree of the observed variation with r squares ranging from 0.555 (Q_{95} in January) to 0.899 (Q_{05} in July). In validation testing, predicted and observed exceedance discharges were all significantly correlated ($p<0.01$) and for most models no significant difference was found between predicted and observed values (Paired samples T-test; $p>0.05$). I classified Korean stream flow regimes with respect to hydraulic and hydrologic regime into four categories: flashier and higher-powered (F-HP), flashier and lower-powered (F-LP), more stable and higher-powered (S-HP), and more stable and lower-powered (S-LP). These four categories of Korean streams were related to with the characteristics of environmental variables, such as catchment size, site slope, stream order, and land use patterns. I then applied the models at 684 ungaged biological sampling sites used in the National Aquatic Ecological Monitoring Program in order to classify them with respect to basic hydrologic characteristics and similarity to the government's array of hydrologic gauging stations. Flashier-lower powered sites appeared to be relatively over-represented and more stable-higher powered sites under-represented in the bioassessment data sets.

Key words : Korean stream flow regime, landscape variables, flow regime classification, biological sampling sites

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