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## Regression models to estimate annual baseflow and baseflow index

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Baseflow is a very important component of streamflow generated from groundwater inflow or discharge. Seventeen gauged watersheds and their characteristics were used to develop regression models for annual baseflow and baseflow index (BFI) estimation in Michigan. Baseflow was estimated from daily stream flow records using the two-parameter recursive digital filter method (i.e., the Eckhardt filter method) for baseflow separation of the Web-based Hydrograph Analysis Tool (WHAT) program. Twelve watersheds were used to develop two regression models for base flow estimation and one model for BFI estimation. The remaining five watersheds were used for model validation. Results indicated that observed average annual baseflow ranged from 162 to 345 mm, and BFI varied from 0.45 to 0.80 during 1967-2011. The average BFI value during the study period was 0.71, suggesting that over 70% of long-term streamflow in the studied watersheds were likely contributed by baseflow. The regression models estimated baseflow and BFI with relative errors (RE) varying from -29% to 48% and from -14% to 19%, respectively. In absence of reliable information to determine groundwater discharge in streams and rivers, these equations can be used to estimate BFI and annual baseflow in Michigan. Taking into consideration methodological limitations (e.g., the same recession constant was used in the studied watersheds for baseflow separation, and the variables in the equations are all considered to be constant except for precipitation), the equations developed in this study have the ability to predict baseflow and BFI in the watersheds across Michigan. It could be useful for water planning and management decisions at the local level, adding to the existing efforts to quantify the effect of groundwater on water balance in the Great Lakes area.

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