Comparison of a new stream base-flow estimation method in two basins using multivariate analysis in the Northern Great Plains

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Stream base-flow estimation is commonly performed by using graphical or chemical hydrograph separation methods that have limitations due to the spatial and temporal availability of data. Current graphical separation methods are limited in that they rely solely on streamflow records, whereas chemical methods are expensive and involve intense data collection. Graphical hydrograph separation methods are applicable to perennial and gaining streams but result in large uncertainty when applied to ephemeral or losing streams that are typical of dry climates.

A new methodology planned for development will consist of multivariate analysis to determine which spatial and temporal variables are the controlling factors for base flow. Data used in the development of this methodology will include geologic, hydrologic, climatic, land surface, and remotely sensed data that are widely available to the public. Factors considered will include geologic media, flow-duration curves, temporal variability of streamflow, stream type, precipitation, drought-severity index, land-surface slope, and vegetation. This research will examine differences in variables controlling base flow between dry and humid climates, perennial and ephemeral streams, and gaining and losing stream reaches. Although the accuracy of each variable will vary, the use of multivariate analyses will help compensate for those variables with low accuracy.

Base-flow estimates were previously calculated for all streams with available streamflow data located in the Williston and Powder River structural basins using the U.S. Geological Survey hydrograph separation software, PART; these streams, in addition to streams not previously analyzed, will be evaluated by using the methodology that is being developed. The study area for this research will include two river basins in the Northern Great Plains region: the Heart River Basin in southwestern North Dakota, which is located in the Williston structural basin, and the White River Basin in southwestern South Dakota.