ESTIMATION OF NUTRIENT LOADS USING CONTINUOUS WATER-QUALITY MONITORING AND REGRESSION ANALYSIS COMPARED TO OTHER LOAD ESTIMATION METHODS

Victoria G. Christensen, Patrick P. Rasmussen, and Andrew C. Ziegler

Biographical Sketch of Authors

All three authors are employed by the U.S. Geological Survey District Office in Lawrence, Kansas. Victoria Christensen and Patrick Rasmussen are hydrologists and are involved in real-time water-quality monitoring projects across Kansas. Andrew Ziegler is the Hydrologic Investigations Section Chief and Water Quality Specialist. He has conducted numerous water-quality studies in Missouri and Kansas related to acidic mine drainage, transport of agricultural chemicals in ground and surface water, aquifer storage and recovery, and reservoir sediment and quality studies. All three authors have contributed to the use of real-time water quality monitoring and statistical analysis to continuously estimate constituent concentrations and loads in Kansas.

Abstract

A common way of estimating constituent loads employs a regression model calibrated to discrete water-quality samples, to relate constituent concentrations to daily value streamflow measurements. Today, several U.S. Geological Survey streamflow gaging stations in Kansas are equipped with water-quality monitors that provide relatively inexpensive, continuous measurements of specific conductance, pH, water temperature, dissolved oxygen, turbidity, and fluorescence. These measurements are useful indicators of a broader range of water-quality conditions and can be used with regression models to estimate real-time loads of selected constituents, such as nitrogen and phosphorus, in streams.

Between 1998 and 2001, about 20 discrete water samples were collected at each of four streamflow gaging stations throughout Kansas and analyzed for total organic nitrogen, total phosphorus, and other constituents of concern. Site-specific regression equations were developed relating nutrient concentrations in the discrete samples to the variables reported by the continuous water-quality monitors. Annual nitrogen and phosphorus loads were estimated using the continuous water-quality measurements and compared to estimates using continuous streamflow measurements and computer models. For more information on continuous water-quality monitoring in Kansas go to http://ks.water.usgs.gov/Kansas/rtqw/