Special Invited Seminar

Department of Civil and Environmental Engineering
Friday November 16, 3:00 PM at Room 224-226 CSU Lory Student Center

Regional Analysis of Hydrologic Data with Bayesian Generalized Least Squares

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Hydrologists often need to estimate hydrologic quantities, such as the annual mean flow, flood quantiles and low-flow statistics for water resources planning and floodplain management, at ungauged sites using regional information. Reis et al. (2005) introduced a quasi-analytic Bayesian analysis for Generalized Least Squares (GLS) regression which has several advantages over widely used estimators developed in earlier work (Tasker and Stedinger, 1985, 1989). The Bayesian approach provides both a measure of precision of the model error variance that earlier analysis procedures lacked, and a more reasonable description of the model error variance in cases where Maximum Likelihood Estimators (MLE) and Method of Moments (MOM) model error variance estimators are zero.

This talk describes improvements in the Bayesian GLS regression analysis to provide a practical regional hydrologic regression methodology. Extensions include regression diagnostic statistics for Weighted Least Squares (WLS) and GLS models, including a pseudo coefficient of determination R^2, Bayesian plausibility, criteria to evaluate the need for either WLS or GLS analyses as replacements for Ordinary Least Squares (OLS), and leverage and influence criteria to identify rogue observations, address lack of fit, and to support gauge network design.

The value of the Bayesian GLS regression procedure is illustrated by considering estimation of the log-space skew coefficient using OLS, WLS and GLS. The 1975 U.S. Bulletin 17B flood skew map is still used today, over 30 years later. The examples demonstrate that the true model error variance for regional skew models is on the order of 0.10 or less, whereas the Bulletin 17B skew map reports a mean square error of 0.30.