OWQ WaQI Note

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Office of Water Quality Water-Quality Information Note 2005.11

Subject: Software— Release of LOAD ESTimator library for S-PLUS (S-LOADEST) documentation and software.

The Office of Water Quality is pleased to announce the "*LOAD ESTimator library for S-PLUS (S-LOADEST)* is now available for download and use.

The library is based on the stand-alone FORTRAN program announced in WaQI 2005.06 Software, released online-only and available at: http://pubs.water.usgs.gov/tm4A5/. That report describes the estimation theory used by the stand-alone program and the library. The report citation is:

Runkel, R.L., Crawford, C.G., and Cohn, T.A., 2004, Load estimator (LOADEST): a FORTRAN program for estimating constituent loads in streams and rivers: U.S. Geological Survey Techniques and Methods Book 4, Chapter A5, 69 p.

Instructions for installing the library can be accessed by use of a web browser at the following address:

> http://bwtst.usgs.gov/apps/s-plus/61/lt.html

The library is designed for use with S-PLUS 6.1 on the Windows operating system.

<u>Background</u>

The LOAD ESTimator library for S-PLUS (S-LOADEST) contains menu-driven functions for estimating constituent loads in streams and rivers. Given a time series of streamflow, additional data variables, and constituent concentration, S-LOADEST assists the user in developing a regression model for the estimation of constituent load (calibration). Explanatory variables within the regression model include various functions of streamflow, decimal time, and additional user-specified data variables. The formulated regression model then is used to estimate loads over a user-specified time interval (estimation). Mean load estimates, standard errors, and 95 percent confidence intervals are developed for user-specified periods.

The calibration and estimation procedures within S-LOADEST are based on three statistical estimation methods. The first two methods, Adjusted Maximum Likelihood Estimation (AMLE) and Maximum Likelihood Estimation (MLE), are appropriate when the calibration model errors (residuals) are normally distributed. Of the two, AMLE is the method of choice when the calibration data set (time series of streamflow, additional data variables, and concentration) contains censored data. The third method, Least Absolute Deviation (LAD), is an alternative to maximum likelihood estimation when the residuals are not normally distributed and the concentration data are not left-censored. The output from S-LOADEST includes diagnostic tests and plots to assist the user in determining the appropriate estimation method and in interpreting the estimated loads.

Comparison To the LOADEST FORTRAN Program

S-LOADEST is the result of a recent effort to convert the core statistical routines in the FORTRAN code to an easy-to-use menu-driven system. Because all of the data are maintained as S-PLUS data sets, the approach to managing the data and the analysis is different from the stand-alone version. The library contains additional functions to prepare calibration and prediction data sets. Documentation for the library is available from the S-PLUS menu bar at Help | Available Help | LT.

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