



Comparison of selected linear and nonlinear time series models of nitrate concentrations in river flows

P. Valent (1), M. Komorníková (2), and J. Szolgay (1)

(1) Department of Land and Water Resources Management, Faculty of Civil Engineering, Slovak University of Technology, Slovakia, (2) Department of Mathematics and Descriptive Geometry, Faculty of Civil Engineering, Slovak University of Technology, Slovakia

The traditional approach in the time series analysis of nitrate concentration in rivers is the decomposition of the original dataset followed by the linear modelling of residuals. The linear models are usually represented by the autoregressive models or their combination with moving average models. However, the advances in the nonlinear time series analysis showed that by applying more sophisticated models better description of the original datasets could be achieved. A comparison of traditionally used linear models of the ARMA class and nonlinear regime-switching models represented by the MSW (Markov switching) and SETAR (Self-exciting threshold autoregressive) models is given on two Slovak rivers: the Hron and the Váh Rivers. In order to meet the requirement for stationarity of the analysed time series when using the linear models the original datasets had to be decomposed, using the additive decomposition, into trend, seasonal and cyclical components and the residuals, which were further used in the linear modelling. One of the big advantages of the nonlinear models with multiple regimes is that they do not require the modelled time series to be stationary and thus they were directly used to model original time series. The performance of particular models was then evaluated based on the minimal value of the sum of squares of the residuals and the visual assessment of the modelled and original time series. The analysis of two time series of monthly nitrate concentrations showed that mainly by using MSW models it is possible to improve the simplest linear model (AR(1)) by almost 75% and achieve a very good visual description of the original time series without the need to maintain its stationarity.