Abstract

Despite the passage of time the problem of transformation of rainfall into runoff still exists, as it can be seen in the following publications (Kurnatowski, 2017; Rodriguez-Rincon *et al.*, 2015; Todini & Biondi, 2017; Chowdary *et al.*, 2012) and many others. With the development of technology and numerical methods some new possibilities of rainfall-runoff relationship modelling appeared. Among them advanced mathematical algorithms deprived of physical meaning based on artificial neural network (ANN) or data-based mechanistic (DBM) and developed mathematical watershed models describing real watershed system structure stand out. Linear reservoir conceptual models are usually a fundamental element of these developed spatially distributed watershed models. Precise analysis of their structure, optimization of parameters procedure and uncertainties remain the current subject of hydrologists considerations.

Five structures of hydrologic linear conceptual rainfall-runoff models were analyzed in the paper: single linear reservoir, Nash cascade, cascade of submerged reservoirs, Diskin model, model of two cascades in parallel: Nash and submerged reservoirs. Results of conducted research showed that linear models used at work were very sensitive to the estimation criterions used while optimization. Most of commonly used objective functions refers to squared errors, which results in high sensitivity to differences in peak values and insensitivity to divergence in low flow values range. Since the use of objective function determines model results in the scope of considered measure, the idea of criterion which takes into consideration several hydrograph features seems to be a good direction of optimization development enabling to obtain a solution satisfying multiple measures. A greater similarity of real and simulated hydrograph might be obtained assuming greater error tolerance of solution with respect to single matching criterion. The assessment of rainfall-runoff conceptual model ability to reproduce shape of flood hydrograph was determined by using a superimposed peak criterion.

Although the superimposed peak criterion and multi-objective criterion performed promising, a little refinement is advisable to improve their performance. The application of cascade of submerged reservoirs instead of one of Nash cascades in Diskin model improves the model efficiency.

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