Stochastic Prediction of Temporal Variations of Karst Groundwater Regime in Function of Sustainable Management: Case Study Mokra Karst Spring (SE Serbia)

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Quantitative and qualitative monitoring of karst groundwater has a very important role in defining the strategy of groundwater resource exploitation in a rational and sustainable way. Properly determined frequency of qualitative groundwater monitoring can provide insight into fluctuations in groundwater quality parameters, which can be useful especially if the monitored karst spring is tapped for water supply purposes. Stochastic analysis of karst groundwater quality parameters is an important element of the concept of groundwater resources management, which can provide important data on the functioning of the system, as well as the correlation of input and output data. The success of stochastic analyzes of qualitative parameters will depend on data availability, as well as on their accuracy. Quality parameters that are usually analyzed are those assumed to be directly dependent on the recharge rate and groundwater discharge: turbidity, electrical conductivity, water temperature, etc. In addition to chemical parameters, stochastic analysis can also include the contents of some microcomponents, i.e. bacteria. Stochastic analysis and simulation of qualitative parameters was carried out for time series of precipitation and turbidity in the period October 2016 - September 2017 for the Mokra karst spring which has been tapped for water supply of Niš. Analyzes showed a delay of increased turbidity of 5 days at the Mokra spring, while the discharge reacts on precipitation after 7 days. In other words, turbidity firstly reacts on rainy episodes at the Mokra karst spring, while discharge reacts secondly, and later also increases the values of turbidity by induced suspended material. The enormous increase in turbidity that occurred in 2020 at the Mokra spring during which the entire groundwater source had to be closed, clearly indicates the need to form a model that would announce the arrival of extreme values of qualitative parameters a few days in advance. One of the types of adequate qualitative groundwater monitoring which can be set up to sustainably use karst groundwater is the installation of an early warning system (EWS) that can help water companies to quickly respond to any changes in the input signals of karst systems. EWS has a role in the instantaneous observation of the karst

system reaction to changes in the chemical characteristics of the input signal. With EWS, it is possible to monitor karst events caused by rainy episodes using satellite networked groundwater measurement and sampling stations in combination with analyzes of microbiological fecal pollution indicators in the laboratory.

Key words: karst groundwater, stochastic model, water quality, early warning system