Studying Causes of Decreasing Groundwater Level with Wavelet-Entropy Method (Case Study: Urmia Aquifer)

Abstract

The largest source of water supply in the country is Groundwater reserves. Population growth, urban development and increased area of agricultural crops have led to excessive pressure on these resources. Urmia aquifer is one of aquifers that in recent years faced a severe drop in groundwater level. In this study, with considering the complexity of the rainfall, evaporation, temperature, discharge of hydrometric stations and discharge exploitation wells, contribution of each of factors on the rate of decreasing groundwater level in Urmia aquifer was determined. In order to evaluate complexity was used of a hybrid the wavelet transform and entropy method. To calculate complexity, monthly time series were used for a period 16 years (2001-2017). Then, the time series was divided to three equal parts and the complexity changes was performed based on the wavelet-entropy criterion (SWS) in these intervals. For this purpose, each of the time series was decomposed by wavelet functions in four levels of decomposition into approximation and details sub series. This decomposition is done to extract the coefficients of details. By extraction of details coefficients, wavelet energy was calculated and normalized at each levels. Finally, using the normalized energies at each level, the wavelet-entropy criterion (SWS) was obtained for each of the time. After calculating the percent changes of SWS, the results were compared and evaluated. Results showed that the SWS or wavelet-entropy criterion was reduced in all selected observation wells at all time intervals, which indicates a reduction in the complexity of the groundwater level fluctuations in the Urmia aquifer and as a result of the aquifer's disease. Generally, the discharge of exploitation wells is the main factor and after that, the temperature is the second parameter which affected on decreasing groundwater level. Parameters of rainfall, evaporation and flow of rivers have not played any role in the decreasing groundwater level in Urmia aquifer.

Keywords: Wavelet -Entropy, Urmia Aquifer, Complexity, Croundwater Level.

University of Zabol

Graduate School

Faculty of Engineering

Department of Civil Engineering

The Thesis Submitted for the Degree of Master of Science

(in the field of Civil Engineering-Water Engineering)

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Supervisor

Dr. M. Mollaeinia

Advisors

Dr. M. komasi

Mr. M. Salkhordeh Haghighi

By

S. Afzali

January 2019