Application of artificial neural network model for groundwater level forecasting in a river island with artificial influencing factors

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Groundwater use has been increased for various purposes like agriculture, industry or drinking water in recent years, the issue related to sustainability on the groundwater use also has been raised. Accordingly, forecasting the groundwater level is of great importance for planning sustainable use of groundwater. In a small island surrounded by the Han River, South Korea, seasonal fluctuation of the groundwater level is characterized by multiple factors such as recharge/discharge event of the Paldang dam, Water Curtain Cultivation (WCC) during the winter season, operation of Groundwater Heat Pump System (GWHP). For a period when the dam operation is only occurred in the study area, a prediction of the groundwater level can be easily achieved by a simple cross-correlation model. However, for a period when the WCC and the GWHP systems are working together, the groundwater level prediction is challenging due to its unpredictable operation of the two systems. This study performed Artificial Neural Network (ANN) model to forecast the groundwater level in the river area reflecting the various predictable/unpredictable factors. For constructing the ANN models, two monitoring wells, YSN1 and YSO8, which are located near the injection and abstraction wells for the GWHP system were selected, respectively. By training with the groundwater level data measured in January 2015 to August 2015, response of groundwater level by each of the surface water level, the WCC and the GWHP system were evaluated. Consequentially, groundwater levels in December 2015 to March 2016 were predicted by ANN models, providing optimal fits in comparison to the observed water levels. This study suggests that the ANN model is a useful tool to forecast the groundwater level in terms of the management of groundwater.