EGU21-4624
https://doi.org/10.5194/egusphere-egu21-4624
EGU General Assembly 2021

Development of risk assessment model for groundwater level by wavelet-deep learning approach with smart pumping data

Tsai-Ning Weng[1], Chu-Chun Hsu[2], and Yuan-Chien Lin[3]
[1]National Central University, National Central University, Civil Engineering, Taoyuan 32001, Taiwan, Province of China (erica90329@gmail.com)
[2]National Central University, National Central University, Civil Engineering,Taoyuan 32001, Taiwan, Province of China (ce105302038@g.ncu.edu.tw)
[3]National Central University, National Central University, Civil Engineering, Taoyuan 32001, Taiwan, Province of China (yclin@ncu.edu.tw)

Abstract

Groundwater, as a vital existence in human life and economic development, is also one of the stable sources of water resources. Therefore, how to properly utilize groundwater becomes a very important issue when faced with water shortages. However, most of the previous literature uses monthly data as the time scale, and usually uses the historical water level data of the area as the only input factor in the modeling process without considering pumping information and rainfall. This shows that the current studies of small-scale data which is based on the use of multiple factors with hydrological mechanisms to explore and predict the groundwater level is still quite lacking.

Therefore, this study proposed a novel framework combining wavelet analysis and deep learning models called wavelet-deep learning models and taking the Daliao area of Kaohsiung as an example. From the historical hourly observation data during 2017/08/23-2020/01/30, including groundwater level, smart pumping measurement, tidal, and meteorological data. After abstracting important features of each factor with groundwater level by wavelet transform, using deep learning algorithms such as recurrent neural networks (RNN) and long short-term memory (LSTM) model to summarize and predict the impact of multiple variable factors on the groundwater level under different time lags. The results of hourly prediction show that the performance of the LSTM model and RNN model are both reliable in which values of the coefficient of determination () were obtained 0.813 and 0.784, respectively.

This study provides a feasible and accurate approach for groundwater level prediction by understanding and predicting different water level changes that may occur in the Daliao area in advance. As a result, the study will be an important reference for groundwater resources management and risk assessment, and achieve the goal of sustainable use of groundwater resources.

Keywords Groundwater prediction, Wavelet transform, Risk assessment, LSTM