Title: Study of groundwater level early warning in Ganzhou City based on the long-term correlation and machine learning methods

Yourang Zan, Information Center(Hydrology Monitor and Forecast Center),Ministry of Water Resources

Objectives

With the rapid development of groundwater monitoring in China, a large number of high-frequency and high-density groundwater level monitoring data has spawned the demand for in-depth information mining.The establishment of early warning mechanism of groundwater level is an urgent need to implement the strictest water resource management system.

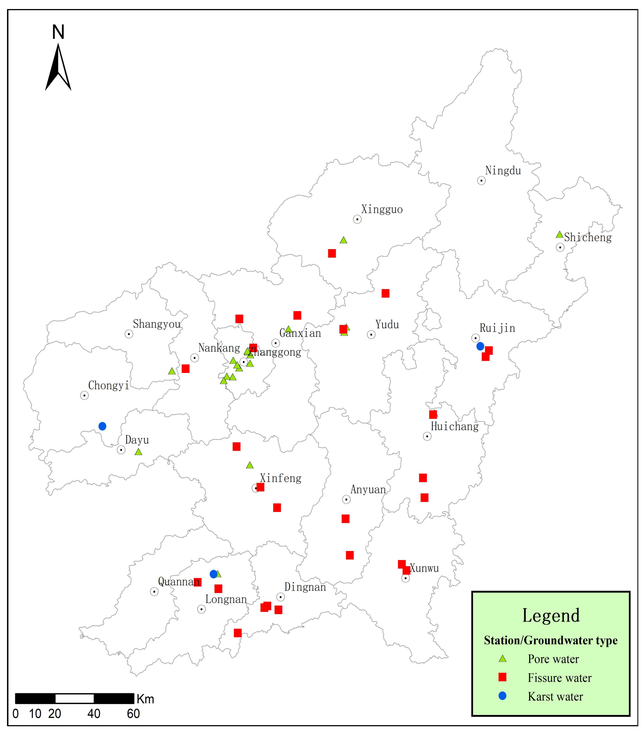

Figure 1 Distribution of Groundwater Monitoring Stations in Ganzhou City

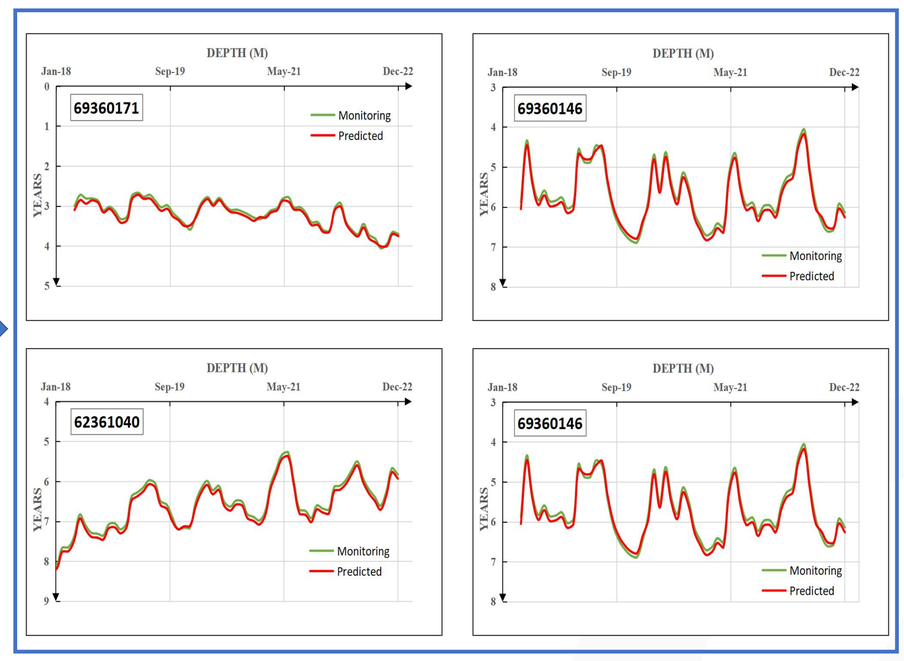

Figure 2 Fitting Curve of Groundwater Level Monitoring Values and Predictions at Typical Groundwater Representative Stations

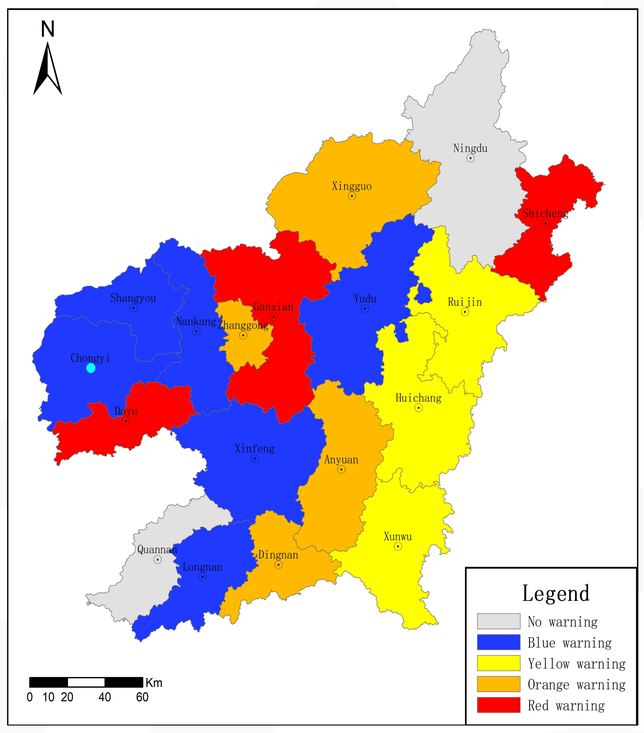

Figure 3 Early warning results of groundwater level in June 2022

Methods

(1) Based on the monitoring data of long-series groundwater level dynamics in Ganzhou City from 2018 to 2022, the groundwater dynamic characteristics of 48 monitoring wells are studied by Seasonal-Trend decomposition procedure based on Loess (STL).
(2) Using the R/ S analysis method (rescaled range analysis) by Python languages to calculate the Hurst (H) exponent, which is used to judge that the time series of groundwater level is completely random or has trend component.
(3) A groundwater level prediction model is constructed by using the time-short memory neural network (LSTM), and the mean square error (MSE), root mean square error (RMSE) and goodness of fit (R^2) are calculated as the evaluation indexes of the model.

Results and Conclusions

(1) the best prediction effect is to use the average groundwater level data of 40-72 months.
(2) The groundwater level within the range of <5%, 5%-10%, 10%-25% and 25%-75% of the monthly average groundwater level value is defined as red, orange, yellow and blue warnings, respectively, and the groundwater water level greater than 75% does not alarm, forming a groundwater water level early warning mechanism.
(3) The research results can provide an effective analysis method for the determination of groundwater control indicators in Ganzhou City and the same geological unit area.