Analysis of the Response of Karst Spring to Precipitation in Longzici karst Area, Southern Shanxi province, China

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In recent decades, the frequent occurrence of extreme weather events, coupled with the continuous increase in the intensity of artificial mining led to a general decline in the groundwater level in the karst areas of northern China. Some large springs even dried up.

Under the background of climate change, the analysis of spring water dynamic characteristics and its response to the atmospheric precipitation are of great significance to reveal the internal relation of groundwater system in karst spring area and the prediction and protection of spring water flow.

This paper selected a typical karst spring Longzici in southern Shanxi province as the object where the karst aquifer developed well. Based on the long time series precipitation monitoring and spring water flow data from 1987-2018, this paper analyzed the characteristics of spring and rainfall and found that they both have some periodicity. The precipitation has 2-3-year peak cycle and the annual average spring flow rate is 3.82 m$^3$/s which had a dynamic fluctuation period of spring about 10 years. The result of regression model analysis of spring flow response to precipitation shows that the spring flow response has a time lag of four years to precipitation. It is most affected by its own spring flow in the previous year and different degrees affection of precipitation in the previous year and three years ago. It is also found that the sensitivity of spring flow to precipitation is influenced by precipitation amount. The effect of annual precipitation with abundant water and dry water on the flow rate of springs is with different delay length. The spring flow response to precipitation in the dry year is more pronounced. The trend analysis shows the groundwater in spring area is greatly influenced by spring own storage capacity and human exploitation.