

Groundwater vulnerability to drought in agricultural watersheds, S. Korea

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Drought can be generally defined by a considerable decrease in water availability due to a deficit in precipitation during a significant period over a large area. In South Korea, the severe drought occurred over late spring to early summer during from 2012 to 2015. In this period, precipitation decreased up to 10-40% compared with a normal one, resulting in reduction of stream flow and reservoir water over the country. It led to a shortage of irrigation water that caused great damage to grow rice plants on early stage. Furthermore, drought resulted in a negative effect on groundwater system with decline of its level. Change of the levels significantly reflects intrinsic characteristics of aquifer system. Identifying drought effects on groundwater system is very difficult because change of groundwater level after hydrological events tends to be delayed.

Therefore, quantitative assessment on decline of groundwater level in agricultural watersheds plays an essential role to make customized policies for water shortage since groundwater system is directly affected by drought. Furthermore, it is common to analyze the time-series groundwater data from monitoring wells including hydrogeological characteristics in company with meteorological data because drought effects on groundwater system is site-specific.

Currently, a total of 364 groundwater monitoring wells including 210 wells for rural groundwater management network(RGMN) and 154 wells for seawater intrusion monitoring network (SIMN) have been operating in agricultural watersheds in S. Korea. To estimate the effect of drought on groundwater system, monthly mean groundwater level data were obtained from RGMN and SIMN during the periods of 2012 to 2015. These data were compared to their past data in company with rainfall data obtained from adjacent weather stations.

In 2012 and 2014, mean groundwater level data in the northern part of the country during irrigation season(April to June), when precipitation was recorded to 10% and 30% of an average one during the past 30 years, decreased up to 1.32 m and 0.71 m compared to that of the normal year, respectively. In 2015, mean groundwater level in the same area with 40% of a normal precipitation decreased up to 0.51-0.77 m.

Consequently, total amounts of groundwater in aquifer have decreased due to the effect of periodic drought events during irrigation season. Effective policies should be required to manage groundwater vulnerability by drought in rural areas, South Korea.