Relationship Between the Rainfall Depth and the Groundwater Level

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The relationship between the rainfall depth and the groundwater level is studied. The groundwater-level data of the Dong-her well observation station at Yunlin county and the rainfall data of four rain-gauge stations nearby the well observation station were collected for analyzing the relationship between the rainfall depth and the groundwater level. Before analyzing the rainfall effect on the groundwater level, non-rainfall effects, such as the barometric pressure and earth tide, were filtered by the BAYTAP-G model.

It was found that the groundwater-level increment ΔH_i^{nh} has close relation with the effective accumulative rainfall depth R_i^{Mn}, and their relation could be described as the equation, $\Delta H_i^{nh} = A\ln(R_i^{Mn} + 1) - \Delta B_i^{nh}$, with two empirical parameters, A and ΔB_i^{nh}, to be determined. The value of ΔB_i^{nh} represents the groundwater-level natural diffusion rate. The value of ΔB_i^{24h} for the Dong-her area was about $116mm$, evaluated by using the filtered groundwater-level data during no-rain periods, as shown in Fig. 1. The effective accumulative rainfall depth R_i^{Mn} includes the present rainfall depth and the considered previous rainfall depths that were weighted by a weighting factor β. A regression analysis shows that the weighting factor $\beta = 1/4$ yields better correlation. Four sets of groundwater levels under rainfall influence (three in 1998 and one in 1999) at the Dong-her well station were used to evaluate the empirical coefficient A. The result showed that the value of A was about 36.1 for the 1998 data, but about 48.9 for the 1999 data, as shown in Fig. 2. More study is need in the variation of A-value.

This study also ponders the relationship between the daily groundwater level increment ΔH_i^{24h} and the effective accumulative rainfall depth R_i^{240} based on the data collected at rainfall stations beyond but nearby the watershed, and its result shows that the groundwater-level variation has significant response to the rainfall beyond the watershed as well as inside the watershed. It implies that precipitation not only within

but also beyond the watershed could recharge groundwater.

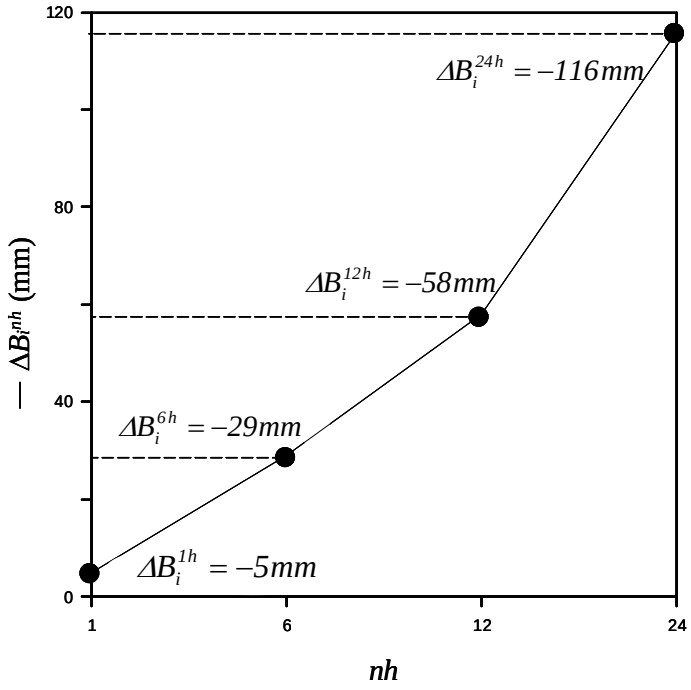

Fig. 1 Groundwater-level diffusion rate at the Dong-her well station.

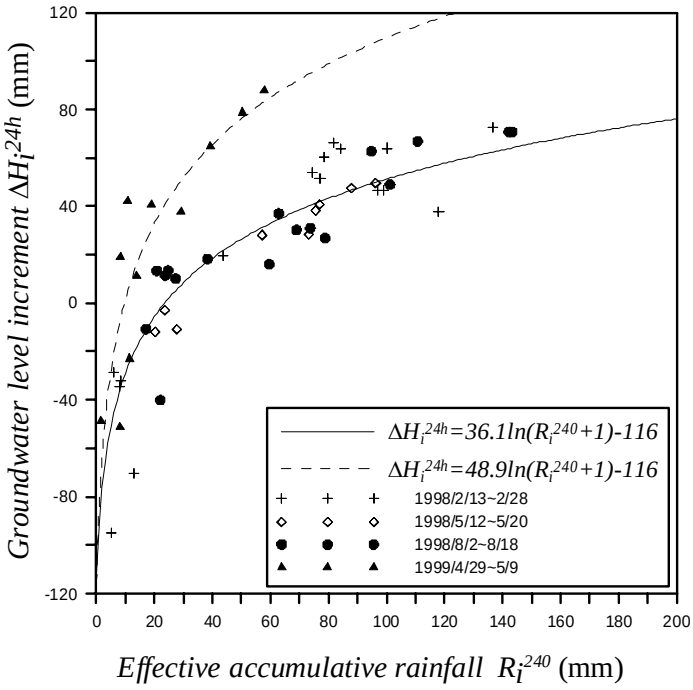

Fig. 2 Relationship between the groundwater level increment and the effective accumulative rainfall depth.