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Can groundwater in the discharge area receive recharge from rainfall in semi-arid areas?

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The definition of discharge area, which could be traced back to Toth (1962), is an area where the flow of groundwater is directed upward with respect to the water table. However, such a definition is subjected to criticism because it is usually accepted that rainfall can infiltrate into the subsurface and recharge the aquifer.

In this study, the water table and soil moisture in the discharge area of an inland watershed in northwestern China with a semi-arid climate are monitored. The water table is recorded using Diver, while soil moistures at ten different depths are recorded using 5TM. The hourly rainfall data is also available in a nearby weather station. Both groundwater and soil water are found to have responses to heavy rainfalls. Soil moisture in the shallow part (<70 cm) increases due to the infiltration of rainfall, and the magnitude of increase in soil moisture is dependent on the amount of rainfall. Soil moisture in the deep part (>90 cm) also have response to heavy rainfalls, however, they have a more direct relation to the dynamics of the water table. Based on the variations in soil moisture, we conclude that the rise in water table is not caused by the in situ infiltration of rainfall, and the infiltrated rainfall got evaporated before arriving at the water table. The vertical flux from regional groundwater flow is found to be the main contribution of water supply to support evaporation.