

Study on Precipitation Infiltration Process in North China Plain

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North China Plain is an important grain and economic crop producing area. Agricultural irrigation, industrial production and domestic water are mainly dependent on the extraction of groundwater. Previous studies on groundwater system in North China Plain believe that some scholars believe that precipitation and irrigation could infiltrate phreatic water, while deep confined groundwater is recharged laterally from rainfall infiltration in piedmont regions. According to the theory of watershed water balance and the fluctuation of groundwater levels, annual groundwater recharge in the North China Plain is 23 billion m³, and the precipitation infiltration coefficient varies from 0.058 to 0.65 in the central and eastern part of the plain. However, the rainfall infiltration coefficient is a theoretical value, without verification by field infiltration experiments. In this study, stratified soil samples from four soil profiles in North China Plain were collected to study the process of rainfall infiltration into unsaturated soil layers by analyzing hydrogen and oxygen isotopes and water chemical composition. Results show that unsaturated soils water near the surface are more enriched in heavier isotopes than that of groundwater, indicating significant evaporation in the near-surface shallow zone. Pollutants such as pesticides, fertilizers and heavy metals are concentrated in unsaturated soil layer, and their concentration is much higher than that of groundwater. The infiltration depth of precipitation does not exceed 200 cm, and the rainfall infiltration cannot be the main water source for phreatic aquifers. After evaporation, the high-concentration salt solution remained on the surface, and precipitation infiltration brought the salt water to the unsaturated layer and enriched in the soil. The high TDS values in unsaturated soil water indicate that precipitation does not supplement groundwater. The predecessors believed that the main aquifers in North China were distributed within 600 meters below the surface. In fact, there is a layer of limestone with a thickness of 1700 m ~ 3 500 m below the sedimentary layer in the North China Plain. Karst water is developed in the limestone fault zone, and some springs and artesian wells are distributed in the karst area. The signatures of hydrogen and oxygen isotopes of karst groundwater and confined groundwater are similar, so it is inferred that they have the same recharge source.

Acknowledgments:

This study is supported by the National Natural Science Foundation of China (515035711), the Fundamental Research Funds for the Central Universities (B18020488).