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Effects of ecological construction on transformation of different water bodies in two hilly and gully watersheds on Loess Plateau

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Water is the most essential resource for the ecological and biological survival of organisms as well as being an important strategic socio-economic factor. Stable isotopes of δD and δ18O in water are important indicators of hydrological and ecological process. In this study, temporal and spatial variations in δD and δ18O and transformations between three water bodies (precipitation, surface water, and groundwater) were studied in two contrasting watersheds of the Wuding River, China. In order to augment understanding of stable isotope spatial patterns and water transmission times under ecological construction, a total of 1028 water samples were collected from the 30 sites, and 79 precipitation samples were collected at the weather station. The results of this study show that the range of variation of the three different water bodies occurred in the order precipitation > surface water > groundwater, the local meteoric water line was above the level of the last two, and the isotopic composition of surface water and groundwater in the controlling basin is more enriched than in the natural basin. Results show that as mileage from the river source increased, both surface water and groundwater isotopes showed a gradual trend towards enrichment, and that water transmission times from precipitation to surface water in Jiuyuangou were 1.53 times those of Peijiamao. Similarly, the water transmission time (WTT) from precipitation to groundwater was about 7.6 times that of precipitation to surface water, and supply ratios exhibited obvious seasonal variation. Precipitation and groundwater recharged surface water mostly in the dry season, while precipitation and surface water recharged groundwater during the wet season. Data reveal a close connection between precipitation and surface water, while the transformation from surface water to groundwater was slow. Overall, this study shows that ecological construction measures extend the WTTs of different water bodies and obviously enhance water evaporation and fractionation. Ecological construction has therefore significantly altered both ecological and hydrological processes within the river basin. The results of this research are significant as they enhance our understanding of water transformation on the Loess Plateau under ecological construction.