Characteristic of Groundwater-surface Water Interaction and Function Degradation of Hyporheic Zone in Karst Springs

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Groundwater (GW)-surface water (SW) interactions in karst areas may have a strong impact on the quantity and quality of the groundwater system. Although knowledge of karst hydrology has improved in recent decades, the interaction patterns of GW-SW, and understanding of the hyporheic zone (HZ) on improving or deteriorating groundwater remains very limited. Here, we document HZ in a karst basin in subtropical area through study of hydrological, hydrochemical, and biological processes in five karst springs. We found in these karst water systems, the HZ is not limited to the riverbed, but extends into aquifer along the karst conduits. And their interaction patterns are not limited to the mixing GW and SW, but also include mixing of groundwater with other water bodies. In karst groundwater systems dominated by the combination of conduits and fractures, the karst hyporheic zone (KHZ) was classified into four types according to the GW-SW interaction patterns. Research on the five typical springs in the study area showed the formation of KHZ is related to the karst development and the hydrogeochemical gradient of water environment. The ten years’ long-term monitoring results showed groundwater level fluctuated more frequently and more sensitive to the hydrodynamics of river in recent years. The groundwater flow decreased significantly after 2015. The conductivity frequency distributions (CFDs) indicated the total dissolved solids were raised and the contribution of groundwater flow in the components was decreased. The frequency and duration of river backflow events were increased and prolonged. Land uses change and groundwater abstraction were contributed to the degradation of water environment, which then cause the degeneration of KHZ function.