



## **Hydrological connectivity of hillslopes and depression in cockpit karst**

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Conical hills and star shaped valleys are characteristic of cockpit karst. It has a specific geomorphology found in some tropical areas underlain by limestone formations. Subsurface flow from hillslopes is an important contributor to groundwater in the depression. However, processes that control how and when hillslopes connect to karst depression river network system remain unclear. In this study, a multi-scale smoothing kernel derived distance was applied to analyze similarity of spatial and temporal dynamics of a hillslope spring, depression water tables at seven sites (four observation wells and three sinkholes) and catchment outlet flow in a small karst basin located in Guizhou province of southwest China. Results show that hillslope discharge and nearby depression water table varied temporally and showed strong hysteretic relationships. During the initial period of rainfall events when water table is low, the hillslopes and depression are less connected, and the rise of depression water tables generally have several hours lagging behind hillslope spring discharge. However, During the period of rainfall when the depression water table rises to a high level, the hillslopes and depression are adequately connected, and the rise of depression water tables is faster than hillslope spring discharge. Therefore, there is a water table threshold that identifies different connectivity between hillslope and depression units. Moreover, our study identified the main flow paths in depression aquifer that connects the hillslope spring discharge and outlet discharge. The hydrometric connectivity analysis was further proven with the assistance of electrical resistivity tomography (ERT) and stable isotope information.