Field-measured hydrogeologic investigation of groundwater flux in an eogenetic karst aquifer

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It has been recognized that karst aquifers are a unique hydrogeologic system because of strong heterogeneity originating from their complexity of the karst medium. Most karst aquifers have large ranges of flow distributions due to various types of porosity such as matrix, connected fractures, faults, and conduits developed from dissolution. This study experimentally investigated groundwater velocities in the Floridan aquifer within the springshed of Silver Springs, FL, one of the largest freshwater springs in the world with mean discharge of approximately 20 m^3/s. Groundwater velocities were measured *in situ* using passive flux meters (PFMs) and karstic borehole dilution (KBHD). Based on these data and previous tracer tests, we estimated rock matrix and conduit velocities of 0.06 ± 0.02 m/day and 3.05 ± 8.1 m/day. These data were coupled with simple analytical solutions to identify the proportion of the aquifer that contributes most significantly to water flow into the spring with two different modeling scenarios: single domain and dual domain including matrix and non-matrix zones. The dual domain scenario suggest that matrix flow contribute approximately 4% of the total flow while non-matrix flow through conduits and fractures contribute approximately 96% of the total flow, even though the non-matrix zones account for only 5.2% of the total aquifer cross-sectional area, within approximately 3 km from the spring outlet (with the upstream capture zone representing approximately 1% of the springshed area (2300 km). The results offer field-measured hydrogeologic data that can be used for active resource management in the springshed and the simple modeling approach presented in this study might be applicable to other springs to estimate portion of water flows and solute pathways to the spring outlet.