Water Flow in Karst Aquifer Considering Dynamically Variable Saturation Conduit

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The karst system is generally conceptualized as dual-porosity system, which is characterized by low conductivity and high storage continuum matrix and high conductivity and quick flow conduit networks. And so far, a common numerical model for simulating flow in karst aquifer is MODFLOW2005-CFP, which is released by USGS in 2008. However, the steady-state approach for conduit flow in CFP is physically impractical when simulating very dynamic hydraulics with variable saturation conduit. So, we adopt the method proposed by Reimann et al. (2011) to improve current model, in which Saint-Venant equations are used to model the flow in conduit. Considering the actual background that the conduit is very big and varies along flow path and the Dirichlet boundary varies with rainfall in our study area in Southwest China, we further investigate the influence of conduit diameter and outflow boundary on numerical model. And we also analyze the hydraulic process in multi-precipitation events. We find that the numerical model here corresponds well with CFP for saturated conduit, and it could depict the interaction between matrix and conduit during very dynamic hydraulics pretty well compare with CFP.