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Project Title: Karst aquifer effect on stream discharge variation in the Jacks Fork River Basin in the Ozark Highlands

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Abstract: Climate and land-cover changes alter stream-flow amount and variability of a watershed. Effects of climate and land-cover changes on stream-flow vary depending on the magnitude and interaction of these changes, and need to be understood and quantified for a watershed so that local water resource availability can be assessed and socioeconomic development can be pursued in a way mutually sustainable with the natural resources. In this study, the land-cover and climate change effects on the stream discharge of the Jacks Fork River basin in the Ozark Highlands in the south-central United States were examined through three phases: site observation and data collection, model variation and simulation, and numerical experimentation and analysis.

When the effect of climate change and land-cover was evaluated separately, model results showed that the climate effect was nearly invariant with land-cover conditions and defined the range of the basin discharge variation. Land-cover effect, which was in most cases a little bigger than one half of the climate effect, modified the surface water budget to affect the basin discharge variability. However, when land-cover effect was evaluated with concurring climate change, model results showed a significant amplification of the land-cover effect in some climate, equivalent to the magnitude of climate effect, on basin discharge variability. This result indicated a nonlinear effect of land-cover change from interaction with climate in evaporation and transpiration and related surface as well as soil hydrological processes. Owing to this nonlinear effect of land-cover change, the basin peak flow (flood flow) would increase by nearly 80% above the current peak flow, should the forest in the basin be cleared.