Application of time series modeling techniques to improve the performance of a physically-based hydrologic model

Vibhava Srivastava, Wendy D. Graham, Jonathan B. Martin, and Matthew J. Cohen

The Santa Fe River Basin consists of three linked hydrologic units: the upper confined region, the semi-confined transitional region (Cody Escarpment) and the lower unconfined region. In the upper confined region the underlying Floridan aquifer is confined by the Miocene Hawthorn Group which limits mixing of surface and deep ground water, and consequently, hydrologic processes are dominated by surface runoff and surficial stores (wetlands and lakes). In the lower unconfined region, erosion has removed the confining layer allowing direct mixing between surface water and the Floridan aquifer. In this region minimal surface runoff occurs, and there are virtually no stream networks feeding the river. In the transition zone the Santa Fe River sinks in its entirety into the Floridan aquifer, emerging as a first order magnitude spring 6 km to the south. Developing a predictive, basin-scale, physically-based hydrologic simulation model for such a complex hydrologic system remains a research challenge.

The purpose of this study was to investigate the use of Time Series Analysis techniques to improve understanding of the hydrologic flowpaths and response times in the Santa Fe River Basin. Cross-correlations among surface water flow, groundwater level, and precipitation data were used to characterize surface-groundwater interactions throughout the basin, and to develop an improved conceptual model for surface and subsurface flow origins, flowpaths and travel times within the basin. Use of this information to improve the performance of the Watershed Assessment Model (WAM), previously developed for the Santa Fe Basin (SWET, 2004), was investigated.

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