143k Basin Scale Modeling of Multiple Tracer Breakthrough in Fractured Limestone

Rugkiat Perkins, Greg J. Thoma, and Ralph K. Davis

In this paper we report on the use of Modflow for modeling the steady-state and transient response of a fractured karst aquifer. Experiments performed at the Savoy Experimental Watershed (SEW) in Northwest Arkansas were modeled to elucidate features of the subsurface associated with the breakthrough behavior of multiple tracers. Of particular concern in fractured limestone systems is the transport of nutrients and bacteria that enter the system as the result of land applied animal manures. The movement of these contaminants has significant impact on both surface and subsurface water quality because the high degree of surface water and ground water interaction. Many of the subsurface fracture flowpaths ultimately exit as springs and seeps, which are tributary to nearby primary streams. At the SEW, dye tracing has confirmed that a wet-weather losing stream has dual terminal springs located approximately 1/2 kilometer from the losing stream section. A dual porosity Modflow model of the SEW basin was calibrated against observed aquifer heads (from observation wells), spring discharge under low-flow conditions, and subsurface discharge to an adjacent gaining stream. The model was also calibrated under transient flow conditions (through matching the spring hydrographs). Initial simulations using Modflow in conjunction with MT3D to model the transient behavior of multiple tracers (dye, bacteria and clay) injected in May 2004 will be presented.