Improving MODFLOW’s RIVER Package for Unsaturated Stream/Aquifer Flow

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Abstract. Saturated flow is typically assumed for seepage from a stream underlain by an alluvial aquifer. However, if the water table in an unconfined aquifer falls a sufficient distance below the streambed, the head losses in this less conductive layer will cause the region beneath the streambed to become unsaturated. Unsaturated flow transforms streams from constant head boundaries to constant flux boundaries, impacting not only the quantity of stream recharge but also biogeochemical transformations. The objective of this paper is to analyze the impact of unsaturated flow on stream/aquifer exchange. The modeling capabilities of one of the most commonly used groundwater flow models, MODFLOW, in simulating unsaturated stream/aquifer exchange is improved. The effects of unsaturated flow on MODFLOW predictions of aquifer drawdown and stream leakage are illustrated for hypothetical stream/aquifer systems.

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