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Estimating spatio-temporal patterns of groundwater-surface water interactions and solute transport in an irrigated stream-aquifer system

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Abstract Title: Estimating spatio-temporal patterns of groundwater-surface water interactions and solute transport and in the intensively irrigated system

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Abstract: In the irrigated watershed, nitrogen (N) and phosphorus (P) are essential for crop growth, but their application in agricultural areas may result in non-pollution of both surface and subsurface waters. The Soil Water Assessment Tool (SWAT) has been used extensively to identify changes in water and nutrient transport due to land use and water management practices in watersheds of varying scale and complexity. However, performance of the model is limited in watershed systems wherein groundwater discharge is a significant component of streamflow due to the simplistic representation of subsurface processes. In this study, the recently developed SWAT-MODFLOW model is linked a groundwater solute transport model RT3D (Reactive Transport in 3 Dimensions) and applied to a 950 km2 watershed the Lower Arkansas River Valley (southeastern Colorado). This study region has been intensively irrigated for over 100 years and is threatened by shallow water tables and high nutrient concentrations in the groundwater and surface water. The newly developed model was calibrated and tested against stream discharge and nutrient instream loading from 5 stream gauges in the Arkansas River and its tributaries, groundwater elevations from 70 observation wells, and nutrient mass loading from/to the stream system during the 2001-2016 period. After the model is tested, this modeling approach will be suited to explore the fate and transport of chemical species in coupled surface-subsurface systems, and identify plausible best-management practices for controlling nutrient pollution in agricultural watersheds.

***Keywords**:* SWAT-MODFLOW-RT3D; Solute transport; Irrigation.