Artificial Neural Networks Database Development for Modeling Stream-Aquifer Interactions in the Lower Arkansas River Basin of Colorado

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Abstract. The Lower Arkansas River Basin (LARB), one of Colorado's most critical agricultural areas, begins at the outlet of the Arkansas River from the Pueblo Reservoir and extends eastward to the Kansas border. CSU has conducted extensive field data collection efforts over the entire LAR Basin with more intensive monitoring in two representative regions referred to as the Upstream Study Region (USR) and Downstream Study Region (DSR). A basin-wide planning and analysis of conservation practices is needed to improve water quality and sustain the valuable agriculture of this basin. Stream-aquifer interaction is a complex modeling component required for addressing these issues, especially in a river system hydraulically connected to an aquifer receiving recharge from irrigation. Previous studies demonstrated that artificial neural networks (ANN) are powerful tools for modeling complex stream-aquifer relationships. In this study, predicted return flows from well-calibrated MODFLOW-UZF models of the two study regions act as target variables for the ANN. Inputs to the ANNs include georeferenced spatial, temporal, and scenario-based explanatory variables describing the properties of the basin features. Methodologies implemented in the database development are described, including the processing of multiple types, resolution, sources, and formats of the base datasets. The use of geographic information system (GIS) extensibility technology is described as well. The ANNs will be incorporated into a basin-scale model to insure that alternative conservation practices in the irrigated lands of the LARB can be adopted in a manner that complies with basin water rights and the Arkansas River Compact between Colorado and Kansas.