Fine-Tuning Artificial Neural Network Parameters for Modeling Basin-wide Stream-Aquifer Interactions

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Abstract. A basin-wide planning and analysis of conservation practices is needed to improve water quality and sustain the valuable agriculture of the Lower Arkansas River Basin (LARB) while ensuring compliance with basin water rights and the Arkansas River Compact between Colorado and Kansas. This planning and analysis tool consists of a basin-wide Geo-MODSIM model and two well-calibrated regional-scale stream-aquifer numerical models which use MODFLOW-UZF. The basin-scale model leverages the two regional-scale models using artificial neural networks (ANN). An ANN is a machine learning method that has demonstrated in previous studies an ability to simulate complex stream-aquifer relationships and to have a good interpolation ability. The leverage is accomplished by treating georeferenced spatial, temporal, and scenario-based variables as explanatory variables and groundwater return flows simulated by the regional MODFLOW-UZF models as target variables in the ANNs. This talk focuses on the tools and methodologies implemented in fine-tuning the ANN parameters to search for the best-performing ANNs. The tools used in the ANN training are geographic information system (GIS) extension, the *C#* and *Python* coding languages, and *Scikit-Learn* machine learning toolbox. The fine-tuned parameters are sampling method, ANN hidden layer architecture, type of solver, and regularization term parameter.