Neural Network Modeling of Climate Change Impacts on Irrigation Water Supplies in Arkansas River Basin

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Abstract.

The evidence of climate change is mounting. The potential impacts of climate change include changes in snowfall, snowmelt and rainfall amount and intensities. Climate change in the Arkansas River basin in Colorado may have profound effects on water users. Snowmelt is the main source of water supply in this agricultural region.

Water supply is a key factor in determining agricultural potential, and in scientific studies dealing with modeling irrigation water budgets, water supply is usually assumed sufficient. Such an assumption leads to critical uncertainties in these water budgets. The water supply may be affected by changes in quantity, type (snow or rain) and timing of precipitation.

The possible effects of climatic changes on surface water supplies for irrigation in the Arkansas River basin are investigated using an Artificial Neural Network (ANN). ANN models have been found useful and efficient, particularly in problems for which the characteristics of the process are difficult to describe using physically based models. ANNs are capable of identifying complex nonlinear relationships between input and output data sets without prior knowledge of the internal structure of a system.

This study presents a methodology for modeling the impacts of climate change on irrigation water supplies and demonstrates the potential of ANN models for simulating this kind of nonlinear hydrologic behavior. Precipitation in the Rocky Mountains and over the basin area coupled with stream flow is used to quantify the impacts of climate changes on surface water supply for irrigation. A feedforward neural network is trained to map the relation between the water diverted for irrigation (output) and the streamflow/precipitation (inputs). The results from ANN are compared to results from two multivariate models namely Linear Regression (LR) and Least Square Difference (LAD).

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