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Classification of input vectors of ANN model into "regular event" and "extreme event" subsets with fuzzy c-means algorithm

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Estimating future river flows is essential in water resources planning and management. Artificial neural network (ANN) models have been extensively utilized for rainfall-runoff modeling in the last decade. One of the major weaknesses of artificial neural network models is that they may fail to generate good estimates for extreme events, i.e. events that do not occur at all or often enough in the training set. If reliable estimates can be distinguished from unreliable ones, the former can be used with greater confidence in planning and management of the water resources. A fuzzy c-means algorithm is developed to cluster the estimates of the artificial neural networks into reliable and less-reliable river flow values (Kentel, 2009). The proposed algorithm is only tested for a single case (i.e. Güvenç River, Turkey) and produced promising results. In this study, applicability of the fuzzy c-means algorithm for different catchments in Turkey is tested. Three flow gauging stations are selected at four different catchments in mid and south Turkey. First, an ANN is developed for each gauging station; then fuzzy c-means algorithm is used together with the outputs of ANN models to test the success of the clustering algorithm in identifying input vectors that are susceptible to produce unreliable estimates. Results obtained for 12 gauging stations are used to identify the drawbacks of fuzzy c-means algorithm and to suggest modifications to improve the algorithm.

Key words: Future river flow estimation; Artificial Neural Network; fuzzy c-means clustering

Kentel, E. (2009) “Estimation of River Flow by Artificial Neural Networks and Identification of Input Vectors Susceptible to Producing Unreliable Flow Estimates,” Journal of Hydrology, 375, 481-488.