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Quantification of factors influencing preferential flow by utilizing artificial neural network in an experimental catchment of Northern China

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Preferential flow (PF) alludes to the regular and uneven rapid water and solute movement through porous media, commonly soil, permitting lot quicker transport of a variety of contaminants and nutrients which creates vital impacts for ground-water quality and has a direct impact on drinking water and human health. The study quantified the factors influencing preferential flow by utilizing artificial neural network (ANN) based on the experimental results in the sub-humid mountainous catchment of Northern China. High-frequency soil moisture monitoring and ground-penetrating radar detection were conducted from August 2013 to July 2018 to analyze the PF and its controlling factors in the Xitaizi experimental watershed. The study validates the usefulness and practical capability of Artificial Neural Network (ANN) for simulating PF. The approach of ANN modeling depends on the daily time series data for organic matter, particle size, soil stratification, rainfall, and soil moisture content. Five ANNs (T1-T5) with various network configurations have been created, trained and tested in the Matlab routines using the Levenberg Marquardt Back Propagation Algorithm. Enumeration technique has been used to optimize the networks and lastly the best network is utilized to predict the PF values. The values, thus obtained through the ANN model were compared with the observed values of PF. The study not only provides insight into ANN modeling for analyzing PF, but also focuses on the imperative factors that influence the PF, before endeavoring to model it.