Proceedings of the 8th International Conference on Environmental Science and Technology
Lemnos Island, Greece, 8 – 10 September 2003
Full paper Vol. A, pp. 682 - 689

ARTIFICIAL NEURAL NETWORK MODELING OF THE RAINFALL-RUNOFF EXTREME EVENTS

D. PANAGOULIA[1] and N. MARATOS[2]

[1] National Technical University of Athens, Faculty of Civil Engineering, Department of Water Resources-Hydraulic & Maritime Engineering,
5 Heroon Polytechniou, 15780 Zographou, Athens, Greece,
E-mail: dpanag@central.ntua.gr
[2] National Technical University of Athens, Faculty of Electrical Engineering, Department of Signals, Control and Robotics, 9 Heroon Polytechniou, 15780 Zographou, Athens, Greece.

EXTENDED ABSTRACT

An algorithm using a combination of linear least squares and multi-start simplex optimization (LLSSIM), is developed to show the mechanism and parameters of three-layer feed forward ANN models and the potential of such models for simulating and forecasting the high-and low-flow events over a mountainous catchment. The output "rain plus melt" from the snow accumulation and ablation model (SAA) of the US National Weather Service (US NWS) applied on a medium-sized mountainous catchment (the Mesochora catchment in Central Greece) was used as input to ANN model. The RMSE (root mean square error) and %VE (percent volume error) statistics were computed separately for flows above and below the 15-year mean daily flow and were presented as a function of the total annual flow for each data year. The models were calibrated for the first five driest years of the 15-year period. The nonlinear ANN model approach is shown to provide a better representation of the rainfall-runoff extreme conditions (high- and –low flows) than the conceptual soil moisture accounting (SMA) model of the US NWS applied over the same catchment. We should not point out that the less good performance of the SMA model is reflected so much on the ability of the model as it could be reflected on the calibration procedure used. In addition, an 'expert' would not allow the model error bias at various flow levels to deteriorate so much while it is minimizing the error variance. Although the ANN model developed here, by no means, could substitute a physically based conceptual model, the results indicate that the ANN model may provide best performance when dry years of data are used for calibration.

Key words: Artificial neural network, linear least squares and multi-start simplex optimization, conceptual modeling**,** high-and low-flow events, root mean square error, percent volume error.