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Flow Forecasting via Artificial Neural Networks - A Study for Input Variables conditioned on atmospheric circulation

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The paper compares the performance of different structures of Artificial Neural Networks (ANNs) for flow forecasting of the next day in the Mesochora catchment in Northwestern Greece with respect to different input variables. The input variables are historical data of previous days, such as: (a) flows, (b) temperatures conditioned on atmospheric circulation, and (c) rainfalls conditioned on atmospheric circulation too. The training algorithm is the stochastic training back-propagation process with decreasing functions of learning rate and momentum term, for which a calibration process is conducted regarding the crucial parameters values, such as the number of neurons, the kind of activation functions, the initial values and time parameters of learning rate and momentum term etc. The performance of each structure has been evaluated by different criterions, such as (i) the root mean square error (RMSE), (ii) the correlation index (R), (iii) the mean absolute percentage error (MAPE), (iv) the mean percentage error (MPE), (v) the mean percentage error (ME), (vi) the percentage volume in errors (VE), (vii) the percentage error in peak (MF), (viii) the normalized mean bias error (NMBE), (ix) the normalized root mean bias error (NRMSE), (x) the Nash-Sutcliffe model efficiency coefficient (E), (xi) the modified Nash-Sutcliffe model efficiency coefficient (E1), (xii) the threshold statistics (TSp%) for a level of absolute relative error of p% (=1%, 2%, 5%, 25%, 50% and 100%). Here, the calibration process has been based on the voting analysis of the (i) to (xi) criterions. The time period of long-term falling flow (1972-77) is divided in two sets: one for ANN training with the 80% of data and the other for ANN parameters' calibration with the 20% data. The test set for the final verification of behaviour of ANN structures encompasses the following long-term time period with falling flow (1987-92). From the aforementioned analysis the nonlinear behaviour between forecasted flow and historical flows, temperatures and rainfalls has been revealed.