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A multi-stage methodology for selecting input variables in ANN forecasting flows

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Recently, several methods have more or less efficiently dealt with the selection of input variables to artificial neural networks (ANNs) in the hydrology and water resources domain. While the ultimate purpose is to approximate an effective and computationally parsimonious method accounting for non linear input variables to ANNs, very few approaches could reach this target. Moreover, none of these has considered the seasonality as input to ANNs which may be attributed to the influence of natural or anthropogenic variability to hydro-meteorological time series. To this end, a novel methodology is developed for selecting input variables used in artificial neural network (ANNs) models for flow forecasting. The proposed methodology is generic, multi-stage and makes use of data correlations together with a set of crucial statistical indices for optimizing model performance, both in terms of ANN structure (e.g. neurons, momentum rate, learning rate, activation functions) but also in terms of inputs selection. Daily areal precipitation and temperature data coupled with atmospheric circulation in the form of circulation patterns, observed river flow data, and time expressed via functions of sine and cosine (seasonality) were the potential vectors for inputs selection. The historical data concern the mountainous Mesochora catchment in Central-Western Greece. The proposed methodology revealed the river flow of past four days, the precipitation of past three days and the seasonality as robust input variables. However, the temperature of three past days should be considered as an alternative against the seasonality. The produced models forecasting ability was validated by comparing its one-step ahead flow prediction ability to two other approaches (an auto regressive model and a GA-optimized single input ANN).