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Application of Neural Networks for Longitudinal Dispersion Coefficient assessment

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The present study aims at the assessment of longitudinal dispersion coefficient (E_L). So far numerous empirical formulae, based on hydraulic and morphometric characteristic of analyzed river have been proposed by different authors. Most of these formulae have very simple structure and do not take into account sinuosity index. However, it is widely accepted that longitudinal dispersion coefficient would differ in straight and meandering rivers.

Recently, it was shown that Multi Layer Perceptron Artificial Neural Networks (MLP-ANN) can give reasonable assessment of the E_L value (Kashefipour et al. 2002, Rowinski et al., 2005). In this study we present the results of comparison of MLP-ANN, Radial Basis Function Artificial Neural Networks (RBF-ANN), Nearest Neighbour approach (Piotrowski et. al, 2004) and linear regression methods for E_L assessment. Two data sets are investigated. For the first of them all models are trained for the following arrangements of input nodes: channel depth, channel width, cross-sectional averaged water velocity and shear velocity. In the second case sinuosity index was included as additional input variable. Data base applied for the analysis is composed of 81 records from American and Moldovan rivers, divided randomly into training (50 elements) and verification (31 elements) sets.

Measured E_L coefficients vary in a wide range from 0,1m^2/s to 1500m^2/s and therefore log values were applied.

The results clearly show that in both cases for training and verification sets MLP-ANN give the best results. Results obtained by means of RBF-ANN are the second best, but this kind of network has more parameters to be optimized so poorer results may be a consequence of small sample size. Nearest Neighbour approach shows better

results than linear regression for verification sets only, especially in case with sinuosity index, but fails to compete with neural networks. All models perform considerably better when sinuosity index is included, despite the fact that additional input variable increases number of model parameters.

References:

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